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IRON AND STEEL INSTITUTE

SUBJECT AND NAME INDEX

TO VOLS. LXXXIII-CIV

1911-1921

AND TO

VOLS. III-X OF THE
CARNEGIE SCHOLARSHIP MEMOIRS

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PREFACE

THIS volume contains an Index to the whole of the volumes of the *Journal of the Iron and Steel Institute*, and of the Carnegie Scholarship Memoirs, issued during the eleven years, 1911-1921 inclusive. It is in direct continuation of the two previous Index volumes, published in 1901 and 1911, and the three volumes together now form a complete Name and Subject Index of the whole series of publications of the Institute from 1890 to the end of 1921.

In the Subject Index, forming the first part of the present volume, it has been attempted to group references to each main subject as far as possible under one general heading. As examples may be mentioned, "Analyses," "Heat Treatment," "Refractories," etc. Each special subject is again entered under its individual name in alphabetical order, with a cross reference to the general heading under which it has been grouped.

It will be noticed that under the heading "Coal Mining" no references occur of later date than 1916. As this subject is somewhat outside the scope of the Institute, it was thought, on grounds of economy, that abstracts of papers and articles dealing with coal mining, which for many years had formed a section of the Abstracts under the general heading of "Fuel" in the Journal, might without particular disadvantage be discontinued. The publication of statistical tables in the Journal also ceased in 1915.

References to the geographical distribution of minerals and to the industries in the new Succession States, from 1919 onwards, will be found under the names of those States. Information on those particular occurrences or industries prior to 1919 must, of course, be sought under the names of the

States of which the respective Succession States formerly formed a part.

The Name Index forms the second part of the volume, and every effort has been made to render it as complete as possible. In a work of this magnitude it is inevitable that, in spite of the greatest care, some inaccuracies or omissions may have escaped attention, and it is hoped that users of the Index who may observe that a name has been omitted or misspelt, or that a mistake has been made in the attribution of the authorship of any article, will draw attention to such errors.

In conclusion, a tribute is due to Mr. Elsdon, Librarian of the Institute, who compiled the Index, and has laboured unremittingly to perfect it as far as possible, and to produce a work which it is hoped will increase the value of the Journal, and facilitate reference to the vast store of information contained in its pages.

March, 1923.

G. C. LLOYD,
Secretary.

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- ALLEN, WILLIAM EDGAR, obituary notice of. 1915, i. 456.
- ALLEN, WILLIAM HENRY, elected member. 1917, i. 1.
- ALLERTON, LOED, speech at dinner by. 1911, i. 489.
- ALLEYNE, SIR JOHN G. N., Bart., obituary notice of. 1912, i. 406.
- ALLISON, F. G., on macrostructure of cast steel. 1921, i. 464.
- ALLISON, H. B. C., on protective coatings for iron. 1915, i. 628.
- ALLISON, L. R. W., on annealing of metal products. 1920, i. 732.
- ALLNER, on the radium pyrometer. 1914, i. 592.
- ALLOTT, J. R. L., on conservation of fuel. 1921, i. 381.
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- ALLOTT, W., obituary notice of. 1912, i. 408.
- ALLPORT, HOWARD ASTON, obituary notice of. 1915, ii. 203.
- ALMQVIST, HARALD, elected member. 1912, ii. 4.
- ALT, H. L., on economy of heating furnaces. 1914, ii. 352.
- ALTEMUS, CLARENCE LEVY, elected member. 1913, i. 1.
- ALTERTHUM, H., on influence of temperature on Hall effect. 1913, i. 670.
- ALTFETER, H., on properties of steel wire. 1920, i. 746.
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- ALVAREZ, A. C., on an axial strainometer. 1915, i. 604.
- ALZUGARAY, B. DE, on production of vanadium steel. 1912, ii. 555.
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- AMADORI, M., on formation of alloys by electrolysis. 1915, i. 623.
- AMAR, J., on the mechanics of filing. 1914, i. 700.
- AMBERG, R., on electric furnace slags. 1912, ii. 561; 1913, i. 625.
- AMBROSE, J. E., on methods of working coal. 1914, i. 624.
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- AMÉDÉO, R., on welding. 1913, ii. 643.
- AMENDE, F., on steel ingot moulds. 1914, i. 682.
- AMICO, E. D'. *See* D'Amico, E.
- AMINOFF, H., on Marks' patent charcoal kiln. 1915, i. 513.
- AMMON, M. A., on relation of hardness to depth of carburisation. 1913, i. 661.
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- AMSLER, W. O., on manufacture of "exothermic steel." 1913, i. 601, 602.
- ANDEAN, THOMAS JOHN, elected member. 1919, i. 2.
- ANDERSON, A., on blast-furnace practice. 1921, ii. 363.
- ANDERSON, A. E., on explosives and blasting. 1912, ii. 510.
- ANDERSON, A. G., on acid open-hearth process. 1917, ii. 199.
- ANDERSON, ARTHUR G., elected associate. 1917, i. 5.
- ANDERSON, A. G. M., elected member. 1917, i. 1.
- ANDERSON, C., on meteorites. 1913, ii. 513.
- ANDERSON, DAVID MARTIN, elected member. 1913, ii. 3.
- ANDERSON, DONALD SIMPSON, elected member. 1921, i. 2.

- ANDERSON, E. M., on coal in Scotland. 1920, i. 692; ii. 324.
- ANDERSON, F. SCOTT, on electric welding. 1911, i. 638.
- ANDERSON, G. E., on coal in China. 1912, ii. 481.
on iron trade statistics of China. 1912, i. 619.
- ANDERSON, J., on pulverised coal. 1920, ii. 322.
- ANDERSON, JOHN ARNOT, elected member. 1912, ii. 4.
- ANDERSON, J. H., on storage of coal. 1919, i. 645.
- ANDERSON, OSCAR, elected member. 1913, i. 1.
- ANDERSON, R., on oil resources in California. 1916, i. 317.
- ANDERSON, R. J., on influence of chromium in steel. 1918, i. 546.
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on metallurgy of titanium. 1918, ii. 507.
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- ANDERSON, S. H., on steel trolley wire. 1918, i. 548.
- ANDERSON, W. T., on electric cables for collieries. 1913, ii. 565.
- ANDRADE, E. N. DA C., on flow of metals under stress. 1914, ii. 366.
- ANDRES, G. E., on foundry costs. 1911, ii. 572; 1912, i. 525.
- ANDREW, F., on casting of cylinder linings. 1917, i. 354.
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- ANDREW, J. H.—
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- Paper* on "The influence of gases upon the critical ranges of the iron-carbon alloys." **C.S.M.**, 1911, iii. 236; experimental, 237; influence of hydrogen, 241; microstructures, 245; conclusions, 247; bibliography, 248.
- Paper* on "Iron-carbon-silicon alloys." **C.S.M.**, 1916, vii. 1.
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on embrittling of iron by caustic soda. 1914, i. 735.
on hardening and tempering high-speed tool steel. 1915, ii. 38.
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on molecular constitutions of high-speed tool steels. 1919, i. 431.
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- ANDREW, J. H., and G. W. GREEN—
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ANDREW, J. H., J. E. RIPPON, C. P. MILLER, and A. WRAGG—

Paper on "The effect of initial temperature upon the physical properties of steel." 1920, i. 527; thermal data, 528; dilatation results, 539; description of dilatometer and methods of working, 541; experimental curves, 545; cooling curves, 548; nickel steels, 549; chromium steels, 553; interpretation of heating and cooling curves, 555; effect of carbon, 556; theoretically possible product on cooling, 560; tempering, 561; resistivity determinations, 570; consideration of the curves, 574; tempering, 581; closer interpretation of tempering curves, 584; magnetic apparatus, 591; quenching, 592; general interpretation of tempering curves, 594; summary and conclusions, 596; carbide expansion as a controlling factor of the gamma to alpha change, 597; final conclusions, 607.—*Discussion*: W. H. Hatfield, 609; J. H. G. Monypenny, 609; F. Rogers, 609; A. McCance, 610; J. H. Andrew (reply), 611.

ANDREWS, (Miss) A. C. P., on petroleum in Papua. 1920, ii. 336.

ANDREWS, CHARLES REGINALD, elected member. 1918, i. 1.

ANDREWS, C. W., on American coke industry. 1913, i. 548.

on manufacture of coke. 1912, ii. 489.

ANDREWS, E. C., on concentration of molybdenite ore in New South Wales, 1916, ii. 381.

on molybdenites in New South Wales. 1917, i. 286.

on molybdenum ores and their preparation. 1917, ii. 342.

ANDREWS, E. S., on tests on cast iron press frames. 1911, i. 645.

ANDROS, S. O., on coal-mining practice in Illinois. 1915, i. 534; 1916, i. 325.

ANDSTRÖM, V., on corrosion of iron. 1911, i. 674.

ANFILOGOFF, N. A., on uses of liquid fuel. 1921, ii. 357.

ANGLADA, J. A., on gas-engines. 1914, i. 620.

ANGLES D'AURIAC, P., on blast-furnace reactions. 1912, i. 495.

on French blast-furnace practice. 1912, ii. 521.

on French iron and steel industry. 1912, i. 624; ii. 634.

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- ANGLES D'AUBRIAC, P., elected member. 1914, ii. xviii.
- ANOSOFF, work of. 1921, ii. 419.
- ANREP, A., on peat in Canada. 1915, ii. 235; 1916, ii. 398.
- ANSLOW, F., on blast-furnace equipment. 1914, i. 645.
 on direct current compared with three-phase current for driving steelworks plant. 1920, i. 259.
 on ironworks efficiency. 1918, i. 496.
 elected member. 1919, i. 2.
- ANTHONY, G. C., on shearing strength of steel. 1913, ii. 655.
- APPELSTEDT, J. F.—
 Paper on "Methods of transport of raw material in the iron industry, with special reference to the cost of production of pig iron." C.S.M., 1914, vi. 1; awarded Carnegie Research Grant. 1913, i. 26.
- APGAR, F. W., on application to microscopy of mining iron ore. 1913, ii. 514.
- APPEL, H. A., on preservation of mine timber. 1915, i. 531.
- APPLEGATE, K. P., on magnetic properties of steel alloys. 1914, ii. 376.
- APPLEYARD, KENELM CHARLES, elected member. 1919, ii. 2.
- ARBER, E. A. N., on coal in England. 1914, i. 597; 1916, i. 309; ii. 397.
- ARCHBALD, H., on methods of working coal. 1913, ii. 567.
- ARCHBUTT, L., on corrosion of iron. 1912, ii. 609.
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 on influence of heat on hardened tool steels. 1912, i. 378.
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- ARCHBUTT, S. L., on intercrystalline fracture of metals. 1920, i. 742.
- ARCHER, R. S., on atoms and metals. 1921, i. 466.
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- ARCHIBALD, E. H., on composition of coal. 1912, ii. 478.
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- ARCHIBALD, R. S., on mine surveying. 1911, ii. 486.
- ARDAGH, E. G. R., on composition of natural gas. 1915, i. 527.
- ARDELT, R., on new pipe-casting foundry in Germany. 1913, i. 616.
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- AREND, J. P., on metallography in the foundry. 1917, ii. 400.
- ARENS, F., on cast-iron pipe manufacture. 1917, i. 353.
- ARGUELLES, A. S., on life of galvanised iron roofing. 1917, ii. 430.
- ARGUILLERE, F., on methods of working coal. 1914, i. 625.
- ARLT, H., on iron ore in Sweden. 1911, ii. 475.
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- ARMANI, G., on petroleum in Italy. 1915, i. 520.
- ARMITAGE, CHARLES ARTHUR, elected member. 1911, i. 2.
- ARMSTRONG, C. G., on enamelling furnaces. 1921, i. 449.
- ARMSTRONG, G. S., on tool steel. 1913, ii. 669; 1914, i. 670.
- ARMSTRONG, H. E., on fuel economy. 1914, i. 596; 1916, ii. 394; 1919, ii. 103.
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- ARMSTRONG, H. L., on low-temperature carbonisation. 1921, i. 389.
- ARMSTRONG, J. T., on petroleum in England. 1914, ii. 295.
- ARMSTRONG, L. K., on occurrence of tungsten ore. 1911, ii. 483.
- ARMSTRONG, P. A. E., on drill steel from hollow ingots. 1921, ii. 389.
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- ARMSTRONG, PERCY TOWNS, elected member. 1913, ii. 3.
- ARMSTRONG, W. H., on use of compressed air in foundries. 1913, i. 609.
- ARNDT, K., on corrosion of iron. 1911, i. 675; ii. 650; 1912, ii. 611.
on galvanising. 1916, i. 366.
- ARNDT, N., on estimation of methane in producer-gas. 1912, ii. 629.
- ARNOLD, E., on the Lübeck blast-furnaces. 1914, i. 646.
- ARNOLD, H., on analysis of commercial tungsten. 1914, ii. 392; 1915, i. 632.
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- ARNOLD, H. C., on properties of refractory materials. 1918, i. 476.
- ARNOLD, J. O.—
Note on "Record of the discovery of the influence of vanadium on steel." 1915, i. 442; reports of original investigations—first report, 443; second report, 446; third report, 452.
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ARNOLD, J. O., on growth of cast iron. 1911, i. 236.

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Paper, "Supplementary notes on the forms in which sulphides may exist in steel ingots." 1915, i. 271; reference to previous experiments, 271; nature and results of present experiments, 272; additional experiments, 273.—*Correspondence*: R. G. Scott, 275.

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Paper on "The mechanical influence of carbon on alloys of iron and manganese." 1911, ii. 76; chemical compositions, 76; heat treatment of the alloys, 76; turning properties, 77; static mechanical tests, 78; dynamic stress-strain tests, 79; micrographic features of four typical nearly carbonless alloys, 80.—*Discussion*: Sir R. A. Hadfield, 81; J. E. Stead, 83.—*Correspondence*: W. H. Hatfield, 83.

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ARNOTT, J., on Monel metal. 1919, i. 687; 1921, i. 467.

ARNOU, G., on electric steel production. 1911, i. 624.

ARNOULD, C. R., on coal briquetting. 1920, ii. 342.

ARROL, SIR WILLIAM, obituary notice of. 1913, i. 483.

ARROWOOD, M. W., on pulverised coal in foundry practice. 1920, i. 690.

ARSEM, W. C., on graphite. 1912, i. 456.

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ARTHUR, W., on structure of galvanised iron. 1912, ii. 606.

ARTMANN, P., on estimation of phosphorus in iron. 1913, ii. 699.

ASAHARA, G.—

Paper on "Graphitisation of iron-carbon alloys." *See* Honda, K., on radiography of metals. 1921, ii. 409.

ASAKAWA, G., on efficiency of gas engines. 1915, ii. 252.

ASCHMAN, C., jun., on determination of boron in boron steel. 1917, i. 420.

ASEHOFT, FRANK, elected associate. 1917, i. 5.

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- ASHDOWN, H. H., on influence of elements on steel. 1916, ii. 115.
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- ASHFORTH, WILLIAM D. S., elected member. 1920, i. 1.
- ASHLEY, G. H., on bauxite. 1912, i. 455.
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- ASHLEY, H. E., on technical control of the colloidal matter of clays. 1914, ii. 280.
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- ASHMEAD, D. C., on preparation of anthracite. 1921, ii. 359.
- ASHWORTH, J., on coal dust experiments. 1911, i. 573.
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- ASKWITH, SIR GEORGE R., speech at dinner by. 1914, i. 549.
- ASPINALL, F., on mine rescue apparatus. 1914, i. 633.
- ASQUITH, JOHN WILLIAM S., elected member. 1914, ii. xviii.
- ASSE, O. D., on cupola working. 1915, i. 559.
- ASTON, J., on corrosion of iron and steel. 1912, ii. 609 ; 1913, ii. 691 ; 1915, ii. 325 ; 1917, ii. 460.
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 on magnetic properties of special steels. 1912, i. 576.
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- ASTON, R. G., on use of liquid fuel. 1912, i. 476.
- ATAK, F. W., on estimation of molybdenum. 1911, ii. 663.
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- ATHERSON, R. W. H., on blast-furnace flue dust. 1920, i. 707, ii. 346.
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- ATEN, A. H. W., on passivity of iron. 1916, i. 397.
- ATHA, CHARLES GURNEY, elected member. 1917, i. 1.
- ATKINS, E. A., on wire-drawing. 1920, ii. 375.
- ATKINSON, A. A., on coal in New South Wales. 1919, ii. 473.
- ATKINSON, C. J., on influence of heat treatment on strength of low-carbon steel. 1915, i. 585.
- ATKINSON, ERNEST, elected member. 1917, i. 1.

- ATKINSON, F., on development of microscopes. 1920, i. 757.
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- ATKINSON, H. J., on shaft sinking. 1917, i. 330.
- ATKINSON, H. M., on estimation of carbon dioxide. 1912, ii. 627.
- ATKINSON, J. B., on geology of refractory materials. 1920, i. 676.
- ATKINSON, J. S., on use of pulverised coal. 1919, ii. 469; 1920, ii. 321.
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- ATKINSON, ROBERT MORTON, elected member. 1917, ii. 1.
- ATWOOD, W. W., on coal in Alaska. 1912, i. 467.
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- AUBEL, Y. W., on cupolas in open-hearth practice. 1921, ii. 375.
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- AUBIE, P., on malleable cast iron. 1911, i. 605.
- AUBRUN, on sanitation in collieries. 1914, i. 633.
- AUCHY, G., on estimation of sulphur. 1912, i. 602.
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on treatment of ingots while fluid. 1913, i. 635.
- AUDLEY, J. A., on zirconia. 1917, ii. 356.
- AUEL, C. B., on electric welding. 1911, i. 637; 1914, ii. 359; 1915, ii. 296;
1916, ii. 444.
on thermit welding. 1912, i. 553.
on welding tips on cutting tools. 1916, ii. 445.
- AUFHAÜSER, on comparative value of liquid and solid fuels. 1913, ii. 533.
- AUGUSTIN, H., on estimation of carbon in iron and steel. 1912, i. 601.
- AUGUSTINE, C. E., on combustion of lignite. 1919, i. 636.
on combustion tests of coal. 1915, i. 504.
- AULD, JAMES PATON, elected member. 1919, i. 2.
- AUMUND, H., on charging appliances. 1911, i. 580.
- AUPPERLE, J. A., on corrosion. 1921, i. 470.
on tests of coating on galvanised sheets. 1915, ii. 327.
on weight of coating of tinplate. 1914, ii. 389.
- AUST, J. F., on electrical equipment of collieries. 1914, i. 624.
- AUSTIN, K., on by-product recovery. 1914, ii. 294.
- AUSTIN, W.—
Paper on "Gases evolved on heating steel to its melting point in a vacuum." 1912, ii. 236; introduction, 236; apparatus employed, 237; summary of results, 239.—*Correspondence*: F. Rogers, 241; W. Austin (reply), 241.
Paper on "The influence of oxygen on some properties of pure iron." 1915, ii. 157.—*Correspondence*: W. H. Hatfield, 162; T. Turner, 162; Wesley Austin (reply), 163.
- AUTISSIER, on iron ore in Normandy. 1919, ii. 459.
- AUZIES, J. A. A., on briquetting iron ore and flue dust. 1912, i. 450.
- AVEY, D. M., on steel foundry practice. 1919, ii. 490.
- AVIS, J. L., jun., on smelting of iron sand. 1921, ii. 363.
- AYERS, J. G., jun., on carburisation of steel. 1915, ii. 295.
on determination of hardness. 1919, i. 684.
on microstructure of steel. 1919, i. 690.
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Paper on "Reinforced pile foundations for blast-furnaces." 1913, ii. 273; causes of poor subsoils in works, 273; system of foundations (Franki piles) employed in France and Belgium, 273; applications of process, 275. —*Discussion*: A. Lamberton, 279; A. Baar (reply), 279.

BAARE, ERICH, obituary notice of. 1913, i. 484.

BABCOCK, A. H., on corrosion of boilers. 1916, i. 395.

BABCOCK, E. J., on briquetting coal. 1916, ii. 414.

on coal in the United States. 1916, ii. 398.

on producer-gas from lignite. 1916, ii. 408.

on utilisation of lignite. 1912, ii. 475.

BABCOCK, G. DE A., on foundry economics. 1914, ii. 335.

BABOCHINE, E. L., on formation of structurally free cementite in mild steel. 1918, i. 549.

BACH, C., on corrosion of a boiler flue. 1913, ii. 689.

on influence of dimensions of tensile test-bars on results of tests. 1917, ii. 438.

on resistance to slipping of iron in concrete. 1911, ii. 655.

on stresses produced in plates by riveting. 1913, i. 661.

on tests of boiler plates. 1911, i. 649, ii. 617.

on torsional tests on square bars. 1912, ii. 582.

BACHE, F., on utilisation of low-grade fuel. 1919, ii. 471.

BACHILLI, D., on analyses and calorific value of lignites. 1914, i. 595.

BACKERT, A. O., on moulding cast-iron pipes. 1911, i. 600.

on moulding machines. 1917, i. 352.

elected member. 1919, ii. 2.

BACKHEUER, M., on lime in basic Bessemer practice. 1918, ii. 472.

BACON, C. J., on utilisation of waste heat from open-hearth furnaces. 1915, ii. 279.

BADEN-POWELL, MAJOR B. F. S., speech at dinner by. 1911, i. 487.

BADGER, W. L., on determination of moisture in coal. 1912, ii. 627.

BAER, H., on power from peat-gas. 1912, ii. 504.

BAGLEY, CHAS. H. F.—

Paper on "The principles of open-hearth furnace design." 1918, ii. 289; general requirements, 289; open-hearth furnace design (pressure and temperature diagrams), 291; furnace details (port ends), 294; combustion of producer-gas, 298; open-hearth furnace design, 300; waste-heat boilers, 306; conclusion, 307.—*Discussion*: J. O. Arnold, 308; E. H. Saniter, 308; W. A. Bone, 309; H. M. Ridge, 311; Cosmo Johns, 313; C. H. F. Bagley (reply), 314.—*Correspondence*: J. E. Fletcher, 315; C. H. F. Bagley (reply), 317.

Paper on "Modern steel metallurgy (calculation and comparison of processes)." 1919, i. 143; steelworks slags, 146; method of calculation 148; sulphur in the basic process, 153; Bessemer acid process, with molten hæmatite iron (mixed Nos.), 156; Bessemer basic process with molten "Thomas" iron, 157; basic open-hearth (Talbot) process, 158; cold pig and scrap in hot metal open-hearth basic practice, 161; cold pig iron and scrap processes, 162; "Duplex" processes, 171; effect of slag make on output of open-hearth furnace, 182; operating orders, 187; phosphate slags, 183; "general" quality of steels, 189.—*Discussion*: B. Talbot, 192; F. W. Harbord, 193; T. Twynam, 193; T. Turner, 194; J. E. Stead, 195.—*Correspondence*: J. E. Fletcher, 195; F. Rogers, 196; B. Yaneske, 196; C. H. F. Bagley (reply), 197.

- BAGLEY, C. J., on influence of elements on steel. 1916, ii. 113.
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- BAGLEY, D., on recovery of by-products. 1916, ii. 402; 1917, i. 318.
on regenerative ovens. 1917, ii. 369.
- BAGLEY, D. C., on Carl Still system of benzol recovery. 1911, ii. 512.
- BAGLEY, J., on cupola practice. 1919, ii. 490.
- BAGNALL-WILD, R. K., on heat treatment of steel forgings. 1917, i. 383.
- BAHNEY, L. W., on estimation of calcium oxide. 1912, i. 610.
on pyrometry. 1911, i. 537.
- BAIJOT, A., on water-flush packing. 1911, i. 567.
- BAIKOW. *See* BAYKOFF, A.
- BAILEY, E. G., on calorific value of coal. 1913, i. 533.
on sampling coal and coke. 1911, i. 688.
- BAILEY, E. M., on treatment of oil shales. 1921, i. 393.
- BAILEY, IVON ARTHUR, elected associate. 1921, ii. 11.
- BAILEY, R. K., on intumescent kaolinite in Oklahoma. 1917, i. 303.
- BAILEY, RICHARD WILLIAM, elected member. 1920, i. 1.
- BAILEY, T. L., on manufacture of tinplate. 1918, i. 520.
- BAILEY, VICTOR ALBERT, elected associate. 1918, ii. 7.
transferred to membership. 1920, i. 7.
- BAILEY, WILLIAM H., elected member. 1915, ii. 2.
- BAILEY, SIR WILLIAM HENRY, obituary notice of. 1913, ii. 477.
- BAILLE-BARRELE, on coking of Saar coals. 1921, i. 388, ii. 350.
- BAILLIE, A. F., on use of oil fuel. 1918, ii. 457.
- BAILLY, L., on estimation of iron ore in German Lorraine. 1912, i. 621.
elected member. 1920, i. 2.
- BAILY, T. F., on annealing furnaces. 1911, i. 631.
on annealing steel. 1917, ii. 423.
on electric furnaces for heat treatment. 1916, i. 358; 1918, ii. 481; 1919, ii. 510; 1921, i. 436.
on electric reheating furnaces. 1912, ii. 568; 1915, i. 580, ii. 288.
on electrically heated soaking pits. 1919, ii. 501.
- BAIN, E. C., on crystal structure of metals. 1921, ii. 409.
- BAIN, H. F., on coal resources of Alaska. 1912, ii. 485.
on iron ore in China. 1919, i. 620.
- BAIN, JAMES ROBERT, obituary notice of. 1913, ii. 477.
- BAIN, J. W., on composition of natural gas. 1915, i. 527.
- BAINBRIDGE, F.—
Paper on "Effect of fluorspar additions on the phosphates in basic slag,"
C.S.M., 1920, x. 1; Part I—The manurial value of basic slag containing fluorspar, 1; Part II—The manurial value of basic slag containing fluorspar (*continued*), 9; Part III—The nature and solubility of phosphates contained in basic open-hearth slag made with additions of fluorspar, 14. Appendix—The effect of the addition of lime on the citric acid solubility of a basic slag, 38; bibliography, 40.
on blast-furnace gases. 1921, ii. 344.
on electrostatic deposition of flue dust. 1921, i. 404.
on slag in the open-hearth process. 1920, i. 310.
on solubility of basic slags. 1920, i. 722.
elected member. 1919, i. 2.
awarded Carnegie Research Grant. 1919, i. 11.

- BAINES, CHARLES WILLIAM, elected member. 1914, ii. xviii.
- BAIRD, D., on winding ropes. 1911, ii. 531.
- BAIRD, HARRY A., elected member. 1917, ii. 1.
- BAIRD, W. M., jun., on electrical equipment of collieries. 1917, ii. 383.
- BAKER, D., on blast-furnace charging appliances. 1912, ii. 523.
on blast-furnace construction. 1912, i. 494.
- BAKER, D. F., on use of oxygen in blast-furnace operations. 1916, ii. 418.
- BAKER, F. W., on progress of microscopy. 1920, i. 757.
- BAKER, G., on production of sound ingots. 1912, ii. 55.
- BAKER, H. A., on Kent coalfield. 1921, i. 382.
- BAKER, J. H., on forging presses. 1912, ii. 568.
on manufacture of chains. 1913, i. 652.
on rail failures. 1914, i. 710.
- BAKER, M. B., on coal in Canada. 1911, ii. 509.
on iron ore in Ontario. 1911, ii. 477.
- BAKER, SYDNEY ERNEST, elected member. 1913, i. 1.
- BAKER, THOMAS—
Paper on "Gases occluded in steel." C.S.M., 1911, iii. 249; effect of re-heating, 250; effect of rolling, 252; bibliography, 259.
on case-hardening of iron. 1917, i. 380.
on determination of critical points *Arl. Acl.* 1913, ii. 410.
on manufacture of files. 1919, i. 379.
on occlusion of gases in metals. 1919, i. 689.
on oxygen content of open-hearth steel. 1914, ii. 190.
elected member. 1913, ii. 3.
- BAKER, THOMAS, and T. F. RUSSELL—
Paper, "Note on 'The Ball Test.'" 1920, i. 341. *Discussion*: H. Moore, 357; J. C. W. Humfrey, 358; T. Baker (reply), 358.
- BALDUS, P., on drop-forging. 1917, i. 373.
- BALL, J., on manganese ore in the Sinai Peninsula. 1917, i. 284.
- BALL, J. D., on specific resistance of sheet steel. 1914, ii. 377.
on magnetic properties of iron. 1916, i. 385.
- BALL, L. C., on coal in Queensland. 1912, i. 469; 1913, ii. 543.
- BALL, M. W., on petroleum in the United States. 1917, i. 322.
on placer law as applied to petroleum. 1914, ii. 303.
- BALL, S. H., on iron ore in Russia. 1917, ii. 339.
on geology of molybdenite deposits. 1918, i. 473.
on petroleum in Mexico. 1911, ii. 517.
- BALL, T. R., on estimation of titanium. 1914, ii. 395.
- BALLANTYNE, HUGH D., elected member. 1920, i. 2.
- BALLARD, E. H., on costs of steel-making. 1920, i. 710; 1921, i. 428.
- BALLARD, HERBERT, elected member. 1913, ii. 3.
- BALLEY, K. M., on gasification of coal dust. 1921, ii. 357.
- BALLIET, L., on hoisting in collieries. 1915, ii. 253.
- BALLOU, H. W., on use of oil fuel. 1918, ii. 457.
- BALMFORD, ALFRED BICKERTON, elected member. 1920, i. 2.
- BALMFORD, EDWARD, elected member. 1920, i. 2.
- BALZAROTTI, GIUSEPPE, elected member. 1912, ii. 4.
- BAMLETT, A. C., obituary notice of. 1912, i. 409.
- BAMFFYLDE, JAMES WARWICK, elected member. 1921, ii. 8.

- BANCROFT, H., on tungsten ores in Washington. 1914, ii. 273.
- BANCROFT, W. D., on laboratory furnaces. 1912, ii. 616.
- BANERJEE, M. N., on estimation of tin. 1912, ii. 626.
- BANERJEE, S. C., on estimation of tin. 1912, ii. 626.
- BANES, R., on behaviour of firebricks. 1913, ii. 527.
- BANKS, R. M., on Brinell hardness test. 1920, i. 741.
- BANNISTER, C. O., on analysis of special steels. 1921, i. 471.
 on chemical standard samples. 1921, i. 471.
 on heat treatment of steel. 1919, ii. 507.
 elected member. 1913, i. 1.
 awarded Carnegie Research Grant. 1921, i. 9.
- BANSEN, H., on efficient heating of blast. 1920, i. 704.
- BARADUC-MULLER, L.—
 Paper on "The gases occluded in liquid steel." C.S.M., 1914, vi. 216.
 (Interim report on the investigations carried out at the steelworks of the Ougrée-Marihaye Company.)
 on carborundum in manufacture of special steels. 1911, ii. 629.
 on gases occluded in steel. 1916, i. 385.
 on microstructure of metallic silicides. 1911, i. 664.
 awarded Carnegie Research Grant. 1913, i. 26.
- BARAGWANATH, W., on history of iron industry in Australia. 1911, ii. 556.
- BARBANSON, GASTON, elected member. 1921, ii. 9.
- BARBER, C., on coking and by-product recovery. 1916, i. 314.
- BARBER, J. H., obituary notice of. 1911, ii. 451.
- BARBER, TOM, elected member. 1916, i. 2.
- BARBER, W., on methods of working coal-mines. 1913, i. 572.
- BARBEY, J. W., on estimation of carbon in steel. 1917, i. 420.
- BARBIER, P., on separation of alumina from ferric oxide. 1911, ii. 661.
- BARBOUR, P. P., on tungsten in the United States. 1916, ii. 482.
- BARCLAY, SIDNEY FRAZER, elected member. 1919, i. 2.
- BARB, E. E., on laboratory furnaces. 1912, ii. 616.
- BARDENHEUR, P., on critical points of pure carbon steels. 1918, i. 551.
- BARDWELL, E. S., on manufacture of ferro-manganese. 1919, ii. 488.
- BARHAM, G. B., on tungsten ore. 1914, i. 577.
- BARIL, A., on rectification of benzol. 1920, i. 698.
- BARKER, F. C., on crucible furnaces. 1915, i. 568.
- BARKER, H., on corrosion of iron in concrete. 1911, ii. 653.
- BARKER, H. H., on separation of vanadium from sodium uranate. 1916, i. 401.
- BARKER, JAMES, elected member. 1912, i. 2.
- BARKER, JOSEPH, elected member. 1918, ii. 1.
- BARKER, S. G., on the iron-carbon system. 1912, i. 585.
- BARKHAUSEN, G., on metal cores for castings. 1911, ii. 567.
- BARKLEY, J. F., on carbon-dioxide recorders. 1916, ii. 394.
- BARLOW-MASSICKS, L., elected member. 1921, i. 2.
- BARMAN, HARRY DRUMMOND DAWSON, elected member. 1911, i. 2.
- BARNBROOK, JOHN HENRY, elected member. 1917, ii. 1.
- BARNEBEY, O. L., on estimation of iron. 1914, ii. 393; 1915, ii. 333.
 on estimation of manganese. 1917, ii. 467.
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 on estimation of titanium. 1911, i. 687.

- BARNES, E. A., on metal-coating wood patterns. 1917, i. 351.
- BARNES, E. J.—
Paper on "Brinell hardness and tenacity factors of a series of heat-treated special steels." See McWilliam, A.
- BARNES, G., on foundry cores. 1913, i. 613.
- BARNES, G. W., on natural gas for boilers. 1913, ii. 558.
- BARNES, KENNETH NORMAN, elected member. 1917, i. 2.
- BARNES, S. L., on conduction and radiation heat losses. 1921, i. 381.
- BARNES, W., on mechanical diggers for iron ore. 1918, i. 473.
 on methods of mining iron ore. 1918, i. 473.
- BARNET, P. C.—
Paper on "The corrosion of iron in aqueous solutions of inorganic salts." See Friend, J. N.
- BARNETT, V. H., on petroleum in Wyoming. 1915, i. 523.
- BARNHURST, H. R., on use of pulverised coal. 1913, ii. 534; 1914, i. 672; 1917, i. 306; 1918, i. 480; 1919, ii. 469.
- BARR, J. A., on manufacture of ferro-phosphorus in the blast furnace. 1915, ii. 263.
- BARR, W. M., on melting points of firebricks. 1917, ii. 351.
- BARRAL, H., on blast-furnace hoists. 1921, ii. 362.
- BARRATT, T., on electric properties of alloy metals. 1914, ii. 378.
- BARRETT, GUY, and T. B. ROGERSON—
Paper, "Notes on the present knowledge and practice in regard to the briquetting of iron ores." 1917, ii. 7; introduction, 7; Ronay process, 9; Mashek process, 10; processes in which the ore is pressed into moulds and subsequently burnt, 11; Gröndal process, 13; Schumacher process, 16; magnesium chloride process, 17; another Schumacher process, 17; Scoria process, 18; Weiss process, 18; Trainer, Pioneer, and Pollacsek processes, 18; briquetting machines, 19; preparation of pulverised coal, 25; sintering processes, 28; Dwight-Lloyd process, 28; Huntington Heberlein process, 32; Greenawalt process, 33; West process, 36; general observations, 38; bibliography of recent literature, 43.—*Discussion*: Cosmo Johns, 49; W. H. Hewlett, 49; C. H. Ridsdale, 50; Greville Jones, 52; Henry Louis, 52; T. B. Rogerson, 54; Iltyd Williams, 55; H. Bumby, 55.—*Correspondence*: A. C. Dalton, 57; G. Barrett (reply), 58.
- BARRETT, H. G., on German foundry practice. 1916, i. 338.
- BARRETT, J. C., on dry-cleaning blast-furnace gas. 1919, i. 650, ii. 486.
- BARRINGER, L. E., on enamelling steel. 1919, i. 681.
- BARRINGTON, REGINALD WILLIAM, elected member. 1918, i. 1.
- BARBOIS, C., on the Nord coal-field. 1912, i. 463.
- BARROWS, F. W., on foundry patterns and moulding. 1911, i. 599.
- BARROWS, W. A., jun., on iron ore in Minnesota. 1912, ii. 452; 1913, i. 512.
- BARRY, SIR J. WOLFE, on standardisation of engineering materials. 1917, ii. 440.
- BARTEL, D. F., on power from peat-gas. 1912, ii. 505.
- BARTELS, W., on coal industry of Siberia. 1921, ii. 348.
- BARTH, C. G., on standardisation of machine tools. 1917, i. 377.
- BARTHEN, ANDERS IVAR, elected member. 1912, ii. 4.
- BARTHEN, I., on electric smelting of iron ore. 1914, ii. 324.
- BARTLEMAN, R. M., on petroleum in the Argentine. 1911, ii. 516.
- BARTLETT, A. R., on moulding. 1914, i. 644.
- BARTLETT, C. O., on coal-dust burners. 1916, i. 307.
 on Cobasco system for handling coal and coke. 1915, i. 540.

- BARTLETT, C. O., on mechanical drying of ore products. 1915, i. 495.
- BARTLETT, J. H., on application of surface combustion to heat-treatment furnaces. 1919, i. 674.
 on producer-gas fired boilers. 1921, i. 397.
 on producer-gas for metallurgical work. 1917, ii. 380.
- BARTLEY, J., on faulty crucibles. 1911, i. 617.
 on graphite mining in United States. 1916, i. 303.
- BARTON, EDWARD, obituary notice of. 1913, ii. 477.
- BARTON, GILBERT WILLIAM, elected member. 1911, i. 2.
- BARTON, L. E., on estimation of nitrogen in steel. 1915, i. 631.
- BARTON, L. J., on electric furnace practice. 1921, ii. 377.
- BARTONEC, F., on coal in Austria. 1912, ii. 480.
 on iron ore in Poland. 1915, i. 481.
- BARTSCH, W. J., on briquetting of iron ore. 1913, ii. 522.
- BASCHIERI, E., on estimation of molybdenum. 1912, ii. 624.
 on molybdenite in Italy. 1912, ii. 456.
- BASEVI, A., on preparation of moulding sand. 1911, ii. 567.
- BASH, F. E., on forging temperatures of large ingots. 1920, i. 727.
 on pyrometry. 1919, ii. 468.
 on temperature measurement of steel. 1920, i. 719.
- BASKERVILLE, C., on lead-coated iron. 1920, i. 760.
- BASTIN, E. S., on oil shale in United States. 1913, ii. 553; 1919, ii. 478.
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- BASSAL, LOUIS, elected member. 1912, ii. 4.
- BASSETT, R. H., on ore sampling. 1915, ii. 333.
- BASTIN, E. S., on graphite. 1911, ii. 500; 1912, ii. 468; 1913, ii. 724; 1914, ii. 282; 1916, ii. 386; 1917, i. 303.
- BATES, R., on corrosion of iron and steel pipes. 1915, ii. 326.
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- BATES, WILLIAM HAYES, elected member. 1918, i. 1.
- BATHO, C., on distribution of stress in certain tension members. 1913, ii. 651.
- BATSON, R. G. C., on determination of hardness. 1919, i. 684.
 on hardness and wear tests of metals. 1915, ii. 306; 1917, i. 398.
 on notched-bar impact tests. 1921, i. 453.
- BAUCKE, H., on action of electrolytes on metals under stress. 1912, ii. 371.
 on behaviour of copper in notched-bar impact tests. 1912, ii. 382.
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- BAUER, C. M., on coal in New Mexico. 1921, ii. 348.
- BAUER, E., on moulding sand. 1911, i. 601.
- BAUER, E. H., on foundry coke. 1921, i. 388.
- BAUER, O., on compression of ingots by Harmet process. 1912, ii. 565.
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 on corrosion tests on galvanised tubes. 1912, ii. 611.
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- BAUER, O., on tests on blast-furnace slags. 1918, i. 497.
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- BAUMANN, F., on winding ropes. 1911, i. 570; 1913, i. 573; 1914, i. 627;
 1915, i. 536.
- BAUMANN, R., on faulty boiler plates. 1914, i. 711.
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- BAUMGARTEN, K., on ore handling. 1912, i. 445.
- BAUMSTARK, on use of concrete in mines. 1911, i. 564.
- BAURIEDAL, F., on gas-producers. 1912, i. 481.
- BAURIER, H., on analysis of oil shale. 1919, ii. 541.
- BAXTER, GEORGE FRANCIS, elected member. 1917, ii. 2.
- BAXTER, G. H., on coal handling. 1911, i. 578.
- BAXTER, G. P., on atomic weight of metals. 1911, i. 670.
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- BAY, I., on apparatus for gas analysis. 1911, i. 690.
- BAY, K., on coal in Spitzbergen. 1915, i. 508.
- BAYER, A., on cleaning blast-furnace gas. 1914, i. 642.
- BAYKOFF, A., on cooling curves of nickel. 1915, i. 623.
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- BAYLES, F. P., on coke-oven construction. 1911, i. 549.
- BAYLEY, F., on constituents of coal. 1921, i. 385.
- BAYLEY, H. DENNIS, elected member. 1914, i. 1.
- BAYLEY, W. G., on iron ore in Pennsylvania. 1912, ii. 452.
- BAYLEY, W. S., on history of iron mining in New Jersey. 1911, ii. 488.
- BAYLISS, THOMAS ABRAHAM, obituary notice of. 1915, i. 456.
- BAYLISS, T. R., obituary notice of. 1914, ii. 253.
- BAYLISS, W., on methods of iron ore mining. 1913, ii. 517.
- BAYLY, P. G. W., on briquetting slack coal. 1914, ii. 315.
- BAYNE, G. H., on classification of fuel. 1911, i. 539.
- BEACH, CLARENCE HIRAM, elected member. 1913, i. 1.
- BEAL, C. H., on petroleum in the United States. 1918, ii. 456; 1919, ii. 478.
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- BEALL, J. F., on heat treatment of motor parts. 1918, ii. 485.
- BEAN, W. R., on malleable cast iron. 1919, ii. 517; 1921, i. 451.
 on use of pulverised coal in air furnaces. 1918, i. 480.
- BEARCE, H. W., on standard tables for petroleum oils. 1917, i. 325.
- BEARD, GEORGE, obituary notice of. 1913, i. 484.
- BEARD, H., on sheet-rolling practice. 1915, i. 590.
- BEARDMORE, SIR WILLIAM. *See* Invernairn of Strathnairn, Lord.
- BEARDSHAW, W. F., on direct current compared with three-phase current for
 driving steelworks plant. 1920, i. 257.
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- BEATTIE, H. M., on graphite in New York. 1912, ii. 469.

- BEATTIE, J. W., elected member. 1918, ii. 1.
- BEAUMONT, W. W., on corrugation of rails. 1911, ii. 619.
- BEAUVIERE, E., on coal in Indo-China. 1911, ii. 508.
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- BECHTEL, B., on large gas-engines. 1912, ii. 185.
- BECK, E. A., on production of solid ingots. 1913, i. 632.
- BECK, R., on application of microscopy to mining iron ore. 1913, ii. 514.
- BECK, W. J., on manufacture of ingot iron. 1921, i. 420.
- BECKER, A. J., on behaviour of steel under biaxial loading. 1916, ii. 448.
- BECKER, E., on the iron-sulphur system. 1912, ii. 604.
- BECKER, H., on moulding. 1915, i. 564.
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- BECKER, J., on by-product recovery. 1913, ii. 549.
- BECKER, R., on the iron iron-sulphide system. 1913, i. 682.
on modifications of the open-hearth furnace. 1913, ii. 612.
- BECKETT, FREDERICK M., elected member. 1912, ii. 4.
- BECKMAN, J. W., on charcoal industry in Sweden. 1920, i. 693.
- BEDIN, on determination of carbon in ferro-alloys. 1921, ii. 420.
- BEDSON, J. P., on the cold flow of steel. 1913, i. 113.
on failure of boiler plates in service. 1917, ii. 175.
on history of wire manufacture. 1918, i. 520.
on microstructure of commercially pure iron. 1917, ii. 246.
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- BEDSON, NOEL PHILLIPS, elected member. 1914, i. 1.
- BEDSON, P. H., on heat value of fuel. 1911, ii. 504.
- BEDWORTH, R. E., on microstructure of carbon steel. 1920, i. 756.
- BEER, GUIDO, elected member. 1919, i. 2.
- BEESEY, HERBERT, obituary notice of. 1916, i. 270.
- BEESON, A. C., on winding-engines. 1911, i. 569.
- BEESTON, ARTHUR EDWARD, elected member. 1921, ii. 9.
- BEESTON, WALTER GEORGE, elected member. 1921, ii. 9.
- BEET, ARTHUR EDGAR, elected associate. 1917, i. 5.
- BEHAGEL, G., on petroleum in Saghalien. 1911, i. 554.
- BEHR, on coal briquetting. 1915, ii. 256.
- BEHR, L., on construction of recording instruments. 1920, i. 686.
- BEHRENS, H., on moulding machine for railway chairs. 1914, i. 665.
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- BEHRENS, W. A., on the electric pyrometer. 1915, i. 504.
- BEITELSTEIN, A., on electric production of pig iron. 1913, ii. 585.
on concentration and briquetting of Swedish ores. 1914, i. 583.
on Hardanger electric smelting plant. 1914, ii. 324.
- BEIJER, LORENS, obituary notice of. 1911, i. 497.
- BELL, C., on shaft-sinking in collieries. 1913, i. 568.
- BEILBY, SIR G. T., on coal in Great Britain. 1912, ii. 480.
on fuel problems. 1914, i. 596; 1921, ii. 344.
on hardening of metals and alloys. 1914, i. 178; 1915, i. 597.
on hardening effect of cold working. 1911, ii. 602.
- BELAIEW, N. T.—
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on effects of cold-working on the elastic properties of steel. C.S.M., 1918, ix. 166.

on crystallisation and structure of slowly-cooled steels. 1912, ii. 602, 603.

on elastic limit of open-hearth steel. 1917, i. 401.

on history of metallography. 1914, ii. 381.

on inclusions in steel and ferrite lines. 1918, i. 302.

on influence of hot-deformation on qualities of steel. 1918, ii. 35.

on manufacture of armour-piercing projectiles. 1913, ii. 266.

on manufacture of Damascus steels. 1911, ii. 554.

on mechanical properties of steels at high temperatures. 1921, ii. 113.

on metallurgical research in Russia. 1921, ii. 419.

on microstructure of steel. 1911, i. 661.

on open-hearth practice. 1917, ii. 274.

on the reaction between pure carbon monoxide and pure electrolytic iron. 1918, ii. 193, 194.

on relation of macrostructure of steel to its crystallisation. 1913, i. 679.

on Widmanstätten structure. 1911, ii. 643.

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BELASIO, R., on estimation of manganese. 1912, ii. 624.

on estimation of nickel. 1914, ii. 392.

BELBIN, HARRY L., elected associate. 1917, i. 5.

BELCK, W., on discoveries of art of iron manufacture. 1914, i. 651.

BELDEN, A. W., on composition of foundry cupola gases. 1913, ii. 595.

on cupola practice. 1913, i. 605.

on history of coke manufacture in United States. 1912, ii. 493; 1914, ii. 295.

BELDEN, S. B., on coal-cutting machines. 1914, ii. 308.

BELGIANS, H. M., KING OF THE, elected honorary member. 1914, i. 5.

reception by. 1913, ii. 441.

BELK, WALTER PATRICK, elected member. 1911, ii. 9.

BELL, A. F. L., on petroleum in the United States. 1911, ii. 514.

on topping of light oils in California. 1915, ii. 246.

BELL, F. K., on influence of copper on corrosion of steel. 1921, ii. 418.

BELL, G. G., on new coal storage plant. 1915, ii. 254.

BELL, HAROLD, elected member. 1920, i. 2.

BELL, SIR HUGH, Bart.—

Paper on "A bloom of Roman iron found at Corstopitum (Corbridge)." 1912, i. 118; position of Corstopitum, 118; smelting of iron ore by the Romans, 119.—*Note by Professor Henry Louis*: origin of iron bloom, 120.—*Note by Dr. J. E. Stead*: microscopical investigation of bloom, 121; furnace in which bloom was found, 124; chemical analysis, 127.—*Correspondence*: H. Louis, 129; G. Turner, 130; F. Haverfield, 132; J. E. Stead, 133.

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BELL, SIR HUGH, Bart., reference to death of Professor Tschernoff. 1921, ii. 12.

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BELL, JOHN CECIL, elected member. 1921, ii. 9.

BELL, J. M., on atomic weight of zirconium. 1917, ii. 356.

BELL, L., on refractories in the iron and steel industry. 1920, i. 678.

BELL, M. L., on firebricks. 1916, ii. 386; 1920, i. 679.

on standard specifications for refractory bricks. 1918, ii. 443.

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BELL, R., on iron ore in Canada. 1913, i. 510.

BELLAMY, S. R., on Semet-Solvay process. 1921, i. 389.

BELLHOUSE, G., on prevention of accidents in foundries. 1914, i. 668.

BELLIS, A. E., on erosion tests of rifle-barrels. 1919, ii. 532.

on heat treatment of tool steel. 1917, i. 384; 1921, ii. 389.

on time effect in tempering steel. 1918, i. 527.

BELLUCCI, I., on estimation of titanium. 1913, i. 692.

BELNAP, H. W., on faulty castings. 1916, i. 342.

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BEMENT, A., on coal mining in Illinois. 1913, ii. 542.

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BENCKE, A., on enamelling of iron. 1913, i. 653.

on formation of oolitic iron ore. 1914, ii. 266.

BENEDEK, L., on estimation of iron. 1911, i. 685.

BENEDICKS, C.—

Paper on "Allotropy in general and that of iron in particular." 1912, ii. 242; introduction, 242; the conception of allotropy (polymorphy), 242; the allotropy (polymorphy) of silver iodide, 247; allotropy of iron, 256; nature of martensite, 267; relation to ferromagnetism, 267; summary, 270; bibliography, 272.—*Correspondence*: J. O. Arnold, 275; H. C. H. Carpenter, 275; W. H. Hatfield, 277; H. M. Howe, 279; A. Lodin, 282; F. Robin, 282; F. Rogers, 283; C. Benedicks (reply), 283.

Paper on "Experiments on allotropy of iron; behaviour of ferro-magnetic mixtures; dilatation of pure iron." 1914, i. 407; I—Introductory, 407. II—Intensity of magnetisation in ferro-magnetic mixtures, 409; (1) magnetite-quartz mixtures, 409; (2) iron-copper mixtures, 411; (3) nickel-copper mixtures, 413; (4) application on A2 magn., 414; (5) Hadfield's manganese steel, a support of the theory, 418. III—Accurate determination of the dilatation of pure iron, 419; (6) introductory, 419; (7) the differential method used, 420; (8) arrangements for dilatation reading, 424; (9) the mounting of the apparatus-magnetometer, 424; (10) experimental results of dilatation measurements, 425; (11) discussion on the experimental results, 427; (12) magnetostriction at higher temperatures, 432; general view of the allotropy question, 434; (13) allotropy and phase rule, 434; (14) some causes for anomalies in property-temperature curves, 436; (15) A2 is not an allotropic point, 438; summary, 440; bibliography, 442.—*Correspondence*: G. K. Burgess, 444; W. H. Hatfield, 448; A. McCance, 449; A. Sauveur, 451; C. Benedicks (reply), 452.

Paper on "A new thermo-electric method of studying allotropic changes in iron and other metals. 1916, i. 211; introductory, 211; experimental arrangement, 213; experimental results, 217; summary, 220.—*Correspondence*: G. K. Burgess, 221; C. Benedicks (reply), 222.

on action of iron oxides upon acid furnace structure. 1919, ii. 182.

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- BENEDICKS, C., on constitution of martensite. 1918, ii. 502.
 on critical ranges of pure iron. 1913, i. 333.
 on crystallisation of cast iron. 1911, ii. 643.
 on crystallising properties of electro-deposited iron. 1913, ii. 150.
 on electric disintegration of metals and its utilisation for testing purposes. 1912, ii. 382.
 on hardening of metals. 1914, i. 186.
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 on heating and cooling curves of manganese steel. 1913, ii. 198.
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 on iron and steel of ancient origin. 1912, i. 175.
 on magnetic properties of nickel steels and meteoric iron. 1911, i. 408.
 on magnetic and mechanical properties of manganese steel. 1914, i. 127.
 on microstructure of steel. 1911, i. 663.
 on native iron of Ovifak. 1911, i. 525.
 on nickel-chrome steels. 1919, ii. 391.
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 on Reichert's microscope. 1920, i. 758.
 on tenacity and deformation of steel at high temperatures. 1913, i. 284.
 on transformations of allotropic iron. 1913, ii. 182.
- BENEDICT, B. W., on tests with twist drills. 1918, ii. 493.
- BENEKE, on briquetting of iron ore. 1912, i. 451.
- BENGOUGH, CYRIL F., elected member. 1915, ii. 2.
- BENGSTON, SWEN LEOPOLD, elected member. 1916, i. 2.
- BENNARD, W. E., on gauging petroleum wells. 1918, ii. 457.
- BENNER, R. C., on composition of soot. 1913, ii. 536.
 on electro-analysis. 1911, i. 684.
 on estimation of nickel and cobalt. 1911, ii. 663.
 on laboratories. 1911, i. 680.
- BENNETT, A. M., on electric welding. 1914, ii. 359.
- BENNETT, ELLIS H., elected member. 1912, i. 2.
- BENNETT, GEORGE BOWEN, elected member. 1911, i. 2.
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- BENNETT, S. R., on manufacture and uses of ferro-chromium. 1914, ii. 341.
- BENOIT, G., on testing of wire ropes. 1913, ii. 656.
- BENSON, H. K., on low-temperature carbonisation of coal. 1918, ii. 454.
 on producer-gas from waste wood. 1914, i. 619.
- BENSON, J. R., on compressed air in collieries. 1911, i. 565.
- BENT, Q., on use of Mayari iron in foundry practice. 1913, i. 608.
- BENTHAL, JOHN LAWRENCE, elected member. 1919, ii. 2.
- BENTLEY, GEORGE HERBERT, elected member. 1920, i. 2.
- BENTLEY, JOHN LLOYD—
Papers on "The corrosion of nickel, chromium, and nickel-chromium steels." See Friend, J. N.
Paper on "The mechanism of corrosion." See Friend, J. N.
 elected member. 1913, i. 1.
- BENTON, EDWIN W., elected associate. 1917, i. 5.
 transferred to membership. 1920, i. 7.
- BENTZ, on iron ore in Sardinia. 1915, i. 481.
- BERESFORD-JONES, HARRY, elected member. 1912, ii. 5.

- BERESLAVSKY, E., on slag cement. 1919, i. 653.
- BERG, C. P., on manufacture of high-speed tool steel. 1911, i. 636.
- BERG, G., on iron ore in Finland. 1916, i. 288.
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- BERG, J. D., on rolling-mill engine. 1915, i. 578.
- BERGGREEN, P. H., on iron-carbon compounds. 1914, ii. 382.
- BERGH, S. V., on tests on hammer drills. 1914, ii. 275.
- BERGIUS, on origin of coal. 1912, ii. 478.
- BERGMAN, C. A., on new form of hammer drill. 1914, ii. 275.
- BERGMER, F., on preparation and use of abrasives. 1914, i. 700.
- BERGMESSE, H., on electrolytic deposition of iron and iron-nickel alloys. 1918, ii. 505.
- BERGSTRÖM, H., on by-product recovery in the distillation of wood. 1912, i. 469.
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- BERKELEY, W. N., on flue-gas analysis. 1915, ii. 336.
- BERLIN, W. G., on electric furnace practice. 1920, i. 718.
- BERMANN, M., on welding of iron and steel. 1912, ii. 382, 577.
- BERNARD, VICTOR—
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Paper on "The influence of coalescence on the mechanical properties of steel and of alloys." See Portevin, A. M.
on determination of critical points. 1919, ii. 528.
on diffusion in solids. 1914, ii. 353.
on a hardness-testing machine. 1912, ii. 591.
on macrostructure of steel. 1918, ii. 483.
on persistent fragility in a medium-hard steel forging. 1915, ii. 312.
on protective coatings for iron. 1914, i. 739.
on Widmanstätten structure and its influence on physical properties. 1912, ii. 603.
- BERNATSKY, J., on rotating rolling-mill furnaces. 1911, i. 607.
- BERNDT, G., on impact tests. 1921, i. 455.
- BERNER, on briquetting of lignite. 1921, ii. 359.
- BERNHARDT, F., on open-hearth furnace construction. 1911, ii. 582; 1913, i. 619.
- BERNHEIM, E., on the dry galvanising process. 1912, ii. 579.
- BERR, R., on coal in Spitzbergen. 1914, i. 598.
- BERRIMAN, A. E., on specification of steel for automobiles. 1916, ii. 451.
- BERRY, O. C., on gas-producer for bituminous fuel. 1917, i. 328.
- BERRY, R. A., on recovery of potash from blast-furnace gases. 1918, i. 493.
- BERRY, WALTER RICHARD, elected associate. 1921, i. 5.
- BERTELING, J. F., on iron ore in Michigan. 1912, ii. 451.
- BERTELT, ROBERT, elected member. 1913, ii. 3.
- BERTHELOT, C., on by-product recovery. 1914, i. 607; 1921, ii. 353.
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on production of sulphate of ammonia. 1914, i. 606.
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- BERTHOLD, K., on oil-firing in cupola melting. 1921, i. 411.
- BERTIAUX, L., on electrodes for electrolytic analysis of iron. 1913, ii. 706.
on estimation of impurities in nickel. 1914, i. 744.
- BERTOYA, O., jun., on the determination of the calorific power of oil by the coal calorimeter. 1917, No. 1, 325; 1918, ii. 447.
- BERTRAM, W., on gas-engines. 1921, i. 397.
- BERWERTH, F., on microstructure of steel. 1911, i. 661.
- BESBORODKO, N., on chrome iron ore in Northern Caucasus. 1913, i. 508.
- BESSON, on electric equipment of collieries. 1911, ii. 528; 1912, ii. 509.
- BEST, B. G., on methods of mining iron ore. 1911, ii. 486.
- BEST, HERBERT H., elected member. 1914, ii. xviii.
- BEST, OSWALD FAIRBROTHER, elected member; 1921, i. 2.
- BEST, W., on ancient and modern safety-lamps. 1917, i. 334.
- BEST, W. N., on burners for liquid fuels. 1914, i. 614.
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- BETTERIDGE, G. B., on testing permanent magnets. 1917, i. 411.
- BETTINI, RAFFAELE, obituary notice of. 1916, ii. 361.
- BEUKENBERG, WILHELM, elected member. 1912, ii. 5.
- BEURET, P., on grinding cracks. 1921, ii. 384.
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- BEUTELL, A., on measurement of gases in steel. 1920, i. 720.
- BEVAN, REES PRESS, elected member. 1917, ii. 3.
- BEVAN, T. H., on petroleum in Mexico. 1917, i. 323.
- BEVERIDGE, W. W. O., on estimation of tin in tinplate. 1911, ii. 660.
- BEYER, H., on enamelling of cast iron. 1921, i. 448.
- BEYER, J., on preparation of magnetic iron oxide. 1911, ii. 493.
- BEYLING, on explosives testing gallery at Berne. 1913, i. 571.
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- BEYLING, C., on illuminating power of safety-lamps. 1915, i. 537.
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- BEYNON, SIR JOHN WYNDHAM, elected member. 1917, i. 2.
- BEYSCHLAG, F., on manganese ore in Germany. 1920, i. 672.
on world's resources of iron ore. 1911, i. 794.
- BHATTACHARYYA, H., on estimation of phosphorus in iron. 1913, ii. 699.
- BIAN, E., on German electric-steel works. 1911, i. 627.
- BIBBINS, J. R., on producer-gas. 1911, i. 561.
- BIBBY, J., on electric smelting of iron ore. 1919, i. 647, ii. 488.
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- BIDDISON, P. M., on extraction of gasoline from natural gas. 1916, ii. 407.
- BIDDULPH, ERNEST, elected associate. 1918, i. 7.
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- BIED, on manufacture of silica bricks. 1919, i. 630.
- BIELYSKY, S. V., on structure of carbon steels. 1914, i. 715.
- BIERER, J. M., on heat treatment of nickel steels. 1911, ii. 601.
- BIERMANN, R., on use of blast-furnace gases for heating coke-ovens. 1914, i. 604, ii. 293.
- BIESECKER, A. S., on preparation of anthracite coal. 1916, i. 327.

- BIGGAM, F., on physical tests of boiler plates. 1920, i. 744.
- BIGGER, C. M., on heat treatment of tool steel. 1913, ii. 641.
on spark tests as a means of distinguishing high speed from ordinary steel. 1916, ii. 456.
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- BIGGERT, F. C., on plate-rolling practice and power requirements. 1918, i. 519.
- BIGGIN, ALFRED STANLEY, elected associate. 1917, i. 5.
- BIGGIN, FRANK, elected member. 1917, i. 2.
- BIGOT, A., on high heat-efficiency furnaces. 1919, ii. 497.
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on kaolins, clays, and bauxites. 1921, ii. 340.
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- BIJVOET, J. M., on iron-oxygen system. 1919, ii. 533.
- BILLINGTON, CHARLES, elected member. 1920, i. 2.
- BILLINGTON, E. E., on the weathering of coal. 1914, i. 594.
- BILLINGTON, LAWSON, elected member. 1913, i. 2.
- BILLY, M., on preparation of titanium and vanadium. 1914, i. 744.
- BINDER, O., on coking tests of coal. 1914, ii. 291.
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- BINGHAM, JOHN WILLIAM, elected member. 1915, i. 1.
- BINGHAM, (MISS) KATHLEEN, E., elected member. 1918, ii. 2.
- BINNIE, W. J. E., on corrosion of iron and steel pipes. 1915, i. 627.
- BIRAULT, C., on influence of perforations on elastic limit of structural material. 1913, ii. 652.
- BIRCH, E. W., on heat treatment of steel forgings. 1917, i. 383.
- BIRCHBY, J. A., on gasoline in natural gas. 1914, i. 181.
- BIRD, E. H., on by-product coking. 1921, i. 389.
- BIRD, JOHN, elected member. 1918, i. 2.
- BIRD, ROBERT MONTGOMERY, elected member. 1921, i. 2.
- BIRDELL, BENJAMIN, elected member. 1913, i. 2.
- BIREN, J., on solubility of graphite in iron. 1921, i. 450.
- BIRKETT, MATTHEW S., elected member. 1920, i. 2.
- BIRKHOLZ, R., on gas-firing for boilers. 1914, ii. 305.
- BIRKINBINE, J., on blast-furnaces in Mexico. 1911, i. 587.
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- BIRLEY, SAMUEL, elected member. 1912, i. 2.
- BISHOP, G. M., on estimation of manganese. 1917, ii. 467.
- BISSET, G. A., on specifications for steel flasks for gases. 1912, ii. 593.
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- BITLER, FRANK LINCOLN, elected member. 1916, i. 2.
- BITNER, F., on Nathusius electric furnace. 1917, ii. 412.
- BIXBY, GEORGE BERNARD, elected associate. 1917, ii. 5.
- BJORKSTEDT, W., on efficiency of induction furnaces. 1914, i. 678.
- BLACET, D. N. A., on manufacture of steel for automobiles. 1917, i. 368.

- BLACHE, F., on producer-gas from low-grade fuel. 1919, i. 645.
- BLACHER, C., on the peat fuel industry. 1915, i. 513.
- BLACK, J., on formation of shaft pillars in thin seams. 1916, i. 325.
- BLAQUE, F., on utilisation of low-grade fuel. 1911, i. 540.
- BLACKETT, W. C., on explosions in collieries. 1913, i. 575.
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- BLACKMORE, ALPHONSUS, elected member. 1921, i. 2.
- BLACKWOOD, A. F. S., on a special small converter. 1913, i. 609.
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- BLACKWOOD, P. F., on properties of cast irons. 1914, ii. 363.
- BLAIR, H., on estimation of sulphur in coal-gas. 1911, ii. 669.
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- BLAIR, T. S., jun., on pre-melting of ferro-alloys. 1916, ii. 431 ; 1917, i. 363.
- BLAKE, A. E., on use of gaseous fuel in furnaces. 1919, ii. 471.
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- BLAKE, JAMES, elected member. 1914, ii. xix.
- BLAKE, K. B., on influence of cobalt, nickel, and copper on corrosion. 1917, i. 418.
- BLAKE, W. P., on manganese ore in Arizona. 1911, i. 523.
- BLAKELEY, A. G., on specific gravity of coal. 1911, i. 543.
- BLAKEY, FRED, elected member. 1920, i. 2.
- BLANCO, A., on coal in Bolivia. 1911, ii. 510.
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- BLAND, F., on various types of tramway rails. 1914, ii. 374.
- BLANDFORD, J., on use of cement in collieries. 1917, i. 331.
- BLANK, OTTO, elected member. 1912, i. 2.
- BLASSETT, E., jun., on protective coatings for iron and steel. 1911, ii. 654.
- BLATCHFORD, A. S., on coal-dust explosions. 1916, i. 327 ; 1917, i. 334.
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- BLATCHLEY, R. S., on origin of production. 1911, i. 553.
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- BLAU, E., on mine drainage. 1914, i. 625.
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- BLAUDEL, C., on blowing-engines. 1917, ii. 390.
- BLAUM, on Stenge peat-cutting machine. 1911, ii. 511.
- BLAUVELT, W. H., on by-product coke-ovens. 1914, ii. 292.
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- BLAZY, A., on coal in Austria. 1912, i. 463.
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- BLECKLY, JOHN, jun., elected member. 1913, ii. 4.
- BLECKLY, W. H., obituary notice of. 1912, i. 405.
- BLEECK, A. W. G., on wolframite in India. 1913, ii. 510.
- BLEECKER, W. F., on estimation of vanadium. 1911, i. 684, ii. 665.

- BLEECKER, W. F., on manufacture of ferro-vanadium. 1915, ii. 282.
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- BLEININGER, A. V., on effect of over-firing upon the structure of clays. 1914, ii. 281.
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on properties of fireclays. 1916, ii. 391; 1921, i. 379.
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- BLENKINSOP, C. H., on estimation of carbon in steel. 1913, i. 690.
- BLENKINSOP, G. H., on iron industry of South Africa. 1921, i. 407.
- BLIGHT, FRANCIS JAMES, elected member. 1917, i. 2.
- BLINOW, N., on influence of vanadium and titanium on nitrogen in iron alloys. 1916, ii. 452.
- BLIZARD, J., on combustion of coal. 1918, ii. 470.
on pulverised coal. 1921, ii. 345.
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- BLOME, H., on constitution of basic slags. 1911, i. 620; 1912, ii. 559.
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- BLOOMER, C. E., obituary notice of. 1916, i. 270.
- BLOUNT, B., on accelerated tests for constancy of volume of cement. 1912, ii. 383.
- BLUE, A. A., on case-hardening of manganese steel. 1921, ii. 385.
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- BLUM, L., on basicity of slags. 1921, i. 419.
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on estimation of iron in basic slag. 1915, i. 634.
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- BLUM, W., on estimation of manganese. 1911, ii. 663; 1912, ii. 624; 1913, i. 692.
- BLUME, G. A., on steel castings. 1913, i. 614; 1914, ii. 329.
- BLUMENFELD, R., on American coal-washing machines. 1913, ii. 575.
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- BOAN, ROBERT, elected member. 1913, i. 2.
- BOARDMAN, C. C., on by-product coke-ovens. 1915, ii. 237.
- BOBZYNSKI, J., on origin of petroleum. 1912, ii. 494.
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- BOCK, E., on rupture of a steel flask. 1920, i. 744.
- BODEN, W., elected associate. 1917, i. 5.
- BODIN, V., on resistance tests of refractories. 1921, ii. 342.
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- BOECK, P. A., on apparatus for laboratory work. 1913, i. 687.
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- BOECK, P. A., on use and application of alundum. 1912, ii. 471.
 on uses and applications of celite. 1916, i. 303; 1917, i. 298.
- BOËL, G., obituary notice of. 1912, i. 409.
- BOERICKE, W. F., on mine surveying. 1911, i. 528.
- BOERSCH, F., on ore-loading plant. 1920, i. 675.
- BOETTCHER, F., on firing of open-hearth furnaces. 1921, ii. 376.
- BOGART, H., on brazing high-speed tools. 1917, ii. 429.
- BOGDANOWITSCH, K. J., on iron ore in Russia. 1912, ii. 448.
- BOGITCH, B., on Eggertz method of carbon estimation. 1917, ii. 463.
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- BOGOLUBOFF, P., on estimation of chromium in chromium-tungsten steel. 1911, i. 683.
- BÖHLER, O., on casting of heavy anvil for a steam-hammer. 1911, ii. 569.
- BÖHM, V. C., on manganese ore in Brazil. 1911, i. 524.
- BOHNY, F., on use of high-grade steel for bridge building. 1911, i. 656; 1914, i. 611.
- BOITEUX, J., on casting of bells. 1913, ii. 604.
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- BÖKER, H. E., on coal reserves of Germany. 1913, ii. 716.
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- BOKHORST, S. C., on allotropy. 1915, i. 622.
- BOLESTA-MALEWSKI, on long-wall working in German coal-mines. 1913, i. 572.
- BOLLES, F. G., on manufacture of slag bricks. 1913, ii. 590.
- BOLSOVER, G. R.—
Papers on "The forms in which sulphides may exist in steel ingots."
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 on the microscope. 1920, i. 758.
 elected member. 1917, i. 2.
- BOLTON, H., on coal in the United Kingdom. 1915, ii. 233.
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- BONARDI, J. P., on recovery of molybdenum from wulfenite ores. 1919, ii. 463.
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- BONE, W. A., on action of pyridine on coal. 1919, ii. 473.
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- BONE, W. A., on gaseous combustion at high pressures. 1921, ii. 357.
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 on utilisation of blast-furnace and coke-oven gases. 1913, ii. 111.
- BONE, W. A., SIR R. A. HADFIELD, and A. HUTCHINSON—
 "Report on fuel economy and consumptions in the manufacture of iron and steel." 1919, ii. 11; introduction, 11; historical, 13; organisation of fuel economy in a modern iron and steel works, 21; analysis of present-day fuel consumptions in iron and steel works, 29; blast-furnace returns, 30; plants smelting Cleveland ironstone, 30; plants smelting Lincolnshire ores, 32; plants situated in the Midlands making chiefly foundry and basic iron, 34; plants smelting hematite ores, 36; summary, 36; open-hearth steelworks fuel consumption, 38; steelworks employing "molten pig processes" in conjunction with blast-furnaces, 39; steelworks using "mixed processes," 41; steelworks using "cold processes," 43; summary of results, 45; Bessemer practice, 46; coke consumption in crucible steel melting, 46; concluding remarks, 48. *Discussion*: 97.—*Correspondence*: 125.
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- BONNEROT, S., on case-hardening of iron. 1911, i. 628; 1912, i. 544, ii. 573.
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 on formation and separation of an iron-nitrogen compound. 1914, ii. 382.
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- BONTE, H., on tensile properties of iron and steel. 1921, i. 458.
- BONTEMPI, A., on rust-proofing process. 1916, i. 398.
- BONTSCHIEW, G., on meteorites. 1913, i. 518.
- BOOMER, J. F., on petroleum in the Philippines. 1915, ii. 243.
- BOOTES, EDGAR MIDDLETON, elected member. 1918, i. 2.
- BOOTH, A. E., on underground haulage. 1911, i. 568.
- BOOTH, C. H., on furnace linings. 1921, i. 424.
- BOOTH, F. L., on equipment of collieries. 1914, i. 623.
- BOOTH, H. C., on errors in magnetic testing. 1913, ii. 678.
- BOOTH, MORDAUNT GORE, elected member. 1911, ii. 9.
- BOOTH, W. H., on use of liquid fuel. 1913, i. 558.
- BOOTH, W. K., on electric furnace of special type. 1919, i. 664.
 elected member. 1918, i. 2.
- BOOTH, W. L., on sand-casting ingots. 1919, i. 669.
- BOOTH, W. M., on iron ore in New York. 1913, i. 514.
- BORCHERS, E. K. H., on the "Kapnograph" dust recorder. 1915, i. 551.
- BORCHERS, R., on automatic grabs. 1914, i. 582.
 on handling iron ore. 1913, ii. 517; 1915, ii. 223.
- BORCHERS, W., on electrically-heated crucible. 1911, i. 616.
 on electric smelting of titaniferous ore. 1911, ii. 552.
- BORCK, H., on separation of iron and aluminium. 1912, ii. 623.

- BORDEAUX, A., on coal resources of China. 1914, i. 600; 1915, i. 509.
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- BORGSTRÖM, L. H., on meteorites. 1913, ii. 511.
- BORMANN, W., on manganese-carbon, nickel-carbon, and iron-carbon systems. 1916, ii. 460.
on physical and chemical properties of metals at high temperatures. 1915, i. 618.
on pseudo-eutectic temperature of iron-carbon alloys. 1917, i. 413.
- BÖRNECKE, R., on heat-treatment of steel. 1912, i. 549.
- BORNEMANN, E., on electric conductivity of liquid iron. 1914, ii. 377; 1915, i. 617.
- BORRMANN, C. H., on distillation of tar. 1915, ii. 238.
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- BOSSE, A., on regeneration in the open-hearth furnace. 1913, i. 622.
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- BOST, W. W. A., on charcoal blast-furnaces. 1914, i. 647.
- BOSTOCK, FRANCIS JOHN, elected member. 1918, i. 2.
- BOSWELL, P. G. H., on mica schist for lining furnaces. 1919, ii. 466.
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- BOSWORTH, T. C., on geology of petroleum. 1912, ii. 494.
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- BÖTTICHER, on coal in Germany. 1914, i. 598.
- BOTTOMLEY, CYRIL, elected member. 1919, i. 2.
- BOTTOMLEY, F., on fused silica. 1917, ii. 353.
- BOUCHILLOUX, E., on cupola practice. 1911, i. 592.
- BOUDOUARD, O., on damping of vibrations as a test of iron and steel. 1911, i. 653.
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- BOULTON, W. G., on fireclays of South Staffordshire. 1918, ii. 438.
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- BOURCOUD, H. E., on gasification of powdered coal. 1921, i. 394.
- BOURG, J. N., on case-hardening. 1913, i. 643.
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- BOURION, F., on estimation of chromium. 1914, i. 747.
on separation of chromium and aluminium and analysis of chromite. 1914, i. 747.
on separation of iron from chromium. 1913, ii. 708.
on separation of iron and titanium. 1912, ii. 625.
- BOURNE, GEORGE H., elected member. 1919, i. 2.

- BOUVARD, C., on steelworks in France. 1912, i. 535.
- BOUVAT-MARTIN, J., on ventilation of collieries. 1913, ii. 568; 1916, ii. 412.
- BOVING, J. O., on electric steel furnace statistics. 1917, ii. 409.
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- BOWDEN, E., on coal-dust experiments. 1911, i. 572.
- BOWEN, C. F., on coal in Idaho. 1914, i. 612.
- BOWEN, D., on electric equipment of collieries. 1912, ii. 509.
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- BOWEN, H. G., on corrosion of boiler plates. 1914, ii. 386.
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- BOWEN, I. S., on magnetic analysis of manganese steel. 1921, i. 462.
- BOWEN, M., on cupola construction. 1912, ii. 538.
- BOWEN, W., on pyrometers in foundry work. 1921, i. 412.
- BOWERS, B. M., on electric arc welding. 1912, ii. 577.
- BOWIE, C. P., on apparatus for the manufacture of gasoline. 1917, i. 328.
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- BOWIE, GEORGE CAMERON, elected member. 1917, ii. 2.
- BOWKER, WILLIAM HENRY, elected member. 1916, i. 2.
- BOWLEY, H., on meteorites. 1915, i. 491.
- BOWMAN, H. L., on laboratory equipment. 1912, i. 607.
on meteorites in India. 1911, ii. 484.
- BOWMAN, R. G., on production of molybdenum in the electric furnace. 1911, ii. 592.
- BOWN, R., on magnetic properties of iron. 1917, i. 410.
- BOWREY, S. E., on petroleum by-products. 1917, ii. 376.
- BOWRON, T., on history of iron and steel industry in the United States. 1914, ii. 324.
- BOYCE, E. A., on cost-keeping in foundries. 1913, ii. 609.
- BOYD, ARCHIBALD JOHN, elected member. 1914, ii. xix.
- BOYER, N., on crystallisation of carbon steels. 1913, ii. 675.
- BOYER-GUILLON, A., on laboratory equipment. 1911, ii. 655.
- BOYES, BENJAMIN WILLIAM, elected member. 1921, ii. 9.
- BOYLE, J. J., on estimation of manganese. 1912, i. 605.
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- BOYLSTON, A. C., on atomic weight of phosphorus. 1912, ii. 608.
- BOYLSTON, H. M.—
Paper on "Investigation of the relative merits of various agents for the deoxidation of steel. C.M.S., 1916, vii. 102.
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- BOYNTON, A. J., on blast-furnace operations. 1915, i. 544.
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- BRABY, C., on alteration of Bye-laws. 1915, ii. 4.
- BRABY, F., obituary notice of. 1911, ii. 451.
- BRACE, P. B., on metallurgy of calcium. 1921, ii. 377.
- BRACE, P. H., on wire testing. 1920, i. 746.
- BRADBURY, W. A., on corrosion of iron. 1914, i. 734.
- BRADEN, A. R., on cast-iron dies. 1917, i. 373.
- BRADFORD, L., on uses and properties of zirconia. 1918, i. 556; 1919, i. 668.
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- BRADFORD, PHILIP GREGORY, elected member. 1921, ii. 9.
- BRADFORD, W. D., on production of sound ingots. 1916, ii. 433.
- BRADLEY, GEORGE WILLIAM JAMES, elected member. 1918, i. 2.
- BRADLEY, L., on gas cleaning. 1917, i. 341.
- BRADLEY, R. WATSON, obituary notice. 1914, i. 552.
- BRADSHAW, L., on influence of oxidising atmospheres on refractories. 1921, ii. 341.
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- BRADY, F. W., on occurrence of vanadium. 1911, i. 483.
- BRADY, J. C., on heating value of illuminating gases. 1920, i. 685.
- BRADY, W., on estimation of carbon in steel. 1915, i. 630.
- BRAGG, J. G., on tests of wire ropes. 1919, ii. 526.
- BRAGG, SIR W. H., on X-ray examination of metals. 1919, i. 690 ; 1921, i. 326.
- BRAGGE, G. S., on coal in Derbyshire and Nottinghamshire. 1912, ii. 479.
- BRAID, A. F., on manufacture of ferro-alloys. 1919, i. 668.
- BRAINERD, HOWARD STANFORD, elected member. 1918, i. 2.
- BRAMAN, H. S., on blast-furnace practice. 1919, ii. 483, 485.
- BRAME, J. S. S., on combustion of liquid fuel. 1917, ii. 376.
- on economical use of coal. 1917, i. 306.
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- on purchase of coal on heat unit basis. 1911, ii. 505.
- BRAMWELL, H., on winding in collieries. 1917, ii. 384.
- BRANDON, G. R., on mechanical charging of cupolas. 1911, ii. 560.
- on new design of cupola. 1914, ii. 336.
- BRANDT, L., on analysis of bog iron ore. 1914, i. 746.
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- on estimation of arsenic in iron ores. 1914, i. 746.
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- on estimation of iron. 1915, ii. 334.
- BRANDT, W. V., on manufacture of high-speed tool steel. 1911, i. 636.
- BRANSKY, O. E., on origin of petroleum. 1911, i. 552.
- BRASSERT, H. A., on blast-furnace design and construction. 1914, ii. 318.
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- elected member. 1921, i. 2.
- BRASSEUR, J., on American foundry practice. 1914, i. 668.
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- elected member. 1911, ii. 9.
- BRATLEY, A. S., on winding and winding appliances. 1913, ii. 568.
- BRATLY, ARTHUR, elected member. 1918, ii. 2.
- BRAUND, BASIL KELLY, elected member. 1921, i. 2.
- BRAUNE, H., on influence of titanium as an addition in the cupola. 1915, i. 560.
- BRAUNSTEINER, C., on shaft sinking by compressed air. 1915, i. 530.
- BRAUTIGAM, M., on producer-gas from coke. 1918, i. 485.
- BRAVO, J. J., on iron ore in Peru. 1921, i. 373.
- BRAYSHAW, EDMUND RUSSELL, elected member. 1911, i. 2.
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on influence of heat on hardened tool steels. 1912, i. 378.

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BRAYTON, H. M., on relation of tensile strength and hardness of steel. 1918, ii. 492.

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on volumetric estimation of vanadium. 1914, i. 743.

- BREARLEY, H., presentation of Bessemer Medal to. 1920, i. 11.
- BRECHBÜHL, E., on impact on cast iron. 1913, ii. 655.
- BRECKENRIDGE, L. P., on fuel supply of the world. 1921, i. 381.
- BREEDLOVE, L. B., on cleaning blast-furnace gas. 1921, i. 404.
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- BREGER, C. L., on origin of petroleum. 1911, ii. 513; 1912, i. 473.
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- BRENNAN, P. W., on case-hardening compounds. 1913, i. 644; 1917, i. 381.
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- BRES, P., on estimation of carbon. 1912, ii. 618.
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- BRESIG, A., on a new form of Strache calorimeter. 1912, ii. 473.
- BRETH, N. V., on explosives in collieries. 1916, i. 325.
- BRETHERTON, S. E., on economics of iron ore mining. 1911, i. 530.
- BRETON, L., on coal in France. 1916, ii. 387.
- BRETSCHNEIDER, O., on torsional tests on square bars. 1912, ii. 583.
- BREUER, T., on iron ore calcination. 1911, i. 534.
- BREUIL, P., on calibration of testing machines. 1915, ii. 311.
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- BREWER, on shaft sinking. 1914, i. 621.
- BREWER, R. E., on detection of impurities in steel. 1921, i. 430.
- BREWER, W. M., on iron ore in Canada. 1917, ii. 340.
- BREWSTER, L. L., on cleaning gas. 1911, i. 562.
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- BREYHAN, on new Westphalia breathing apparatus. 1913, i. 576.
- BREYMESSER, H., on electrolytic deposition of iron. 1918, i. 547.
- BREYNAERT, F., on asphalt in Switzerland. 1913, i. 559.
- BREYRE, A., on asphyxiation by blast-furnace gases. 1912, i. 502.
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- BREZINA, A., on meteorites. 1911, i. 525; 1915, i. 491.
- BRIGHT, ARTHUR, elected member. 1913, ii. 4.
- BRIDGES, S. J., on rescue work in collieries. 1913, ii. 572.
on underground fires in mines. 1917, ii. 385.
- BRIDGMAN, P. W., on action of mercury on steel at high pressures. 1911, ii. 622.
- BRIGGS, C. A., on elastic indentation of steel balls under pressure. 1918, i. 537.
- BRIGGS, H., on gases in mines. 1912, i. 488.
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- BRIGGS, R. H., on ironstone mining in Lincolnshire. 1921, ii. 338.
- BRIGHT, G., on cost of electric power in collieries. 1912, ii. 509.
- BRIGHT, W., obituary notice of. 1911, ii. 451.
- BRINELL, J. A., on electrolytic deposition of iron. 1913, ii. 679.
- BRINELY, C. C., on coal handling. 1915, ii. 255.
- BRING, G. G., on Ljungberg's tests on drilling steels. 1915, i. 605.
- BRINSMADE, R. B., on coal in the United States. 1911, i. 547.
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- BRINSMADE, R. B., on mine drainage. 1911, ii. 532.
- BRINTON, P. H. M. P., on estimation of manganese. 1911, i. 684, ii. 662; 1912, i. 609.
- BRISCOE, H. A. V., on atomic weight of vanadium. 1914, i. 748.
- BRISLEE, F. J., on determination of expansion of aluminium. 1912, ii. 607.
- BRISTOL, C. F., on manufacture of crucibles. 1918, ii. 444.
- BRISTOL, MARQUESS OF, speech at dinner by. 1911, i. 487.
- BRITTAIN, LAWRENCE, elected member. 1920, i. 2.
- BROADBRIDGE, W., on froth flotation for coal washing. 1921, i. 398.
- BROCK, R. W., on petroleum in Alberta. 1915, i. 521.
- BRODERICK, T. M., on iron ore in Minnesota. 1921, i. 374.
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- BRODIE, H., on strength of reinforced concrete beams. 1914, i. 712.
- BRODIE, N., awarded Carnegie Research Grant. 1913, i. 27.
- BRODIE, W. M., on petroleum in Ecuador. 1919, ii. 479.
- BROIDO, B. N., on utilisation of waste heat of furnaces. 1917, ii. 415.
- BROMS, OTTO WILHELM, obituary notice of. 1915, ii. 204.
- BRONIEWSKI, W., on appliances for metallography. 1912, i. 579.
on critical points of pure electrolytic iron. 1913, i. 677.
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on history of the iron-carbon theory. 1919, i. 694.
on position of martensite in the iron-carbon diagram. 1917, i. 414.
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- BRONN, J. I., on phosphoric pig iron for deoxidising steel. 1918, i. 511.
- BRONSON, C. B., on heat treatment of rails. 1919, ii. 509.
- BROOK, G. B., on electrolytic deposition of metals. 1911, i. 672.
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- BROOKE, R. E., on sintering plant for flue-dust. 1916, i. 301.
- BROOKE, W. J., on tests of silica bricks. 1917, ii. 351.
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- BROOKS, C. A., on heat treatment. 1921, ii. 390.
- BROOKS, C. K., on manufacture of cast steel chains. 1918, ii. 487.
- BROOKS, J. C., obituary notice of. 1911, ii. 452.

- BROOKS, MAURICE, elected member. 1919, i. 2.
- BROOKSBANK, J., on X-ray examination of metals. 1919, i. 690.
- BROOME, G. H., on machine mining in Australia. 1914, ii. 308.
- BROOMHEAD, EARL CLARENCE, elected member. 1917, i. 2.
- BROPHY, G. R., on case-hardening. 1921, i. 435.
- BROSIOUS, E. E., on steelworks equipment. 1915, ii. 283.
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- BROUARD, C. E., on petroleum in Persia. 1914, i. 610.
- BROUGHALL, E. H., on use of permanent moulds. 1920, i. 712.
- BROUGHTON, H. H., on coal handling. 1915, ii. 255.
- BROWN, ANDREW, elected member. 1913, ii. 4.
- BROWN, A. F., on petroleum in Saghalien. 1911, ii. 514.
- BROWN, ARTHUR LESLIE, elected associate. 1921, i. 5.
- BROWN, A. S., on iron ore resources of the world. 1911, ii. 682.
- BROWN, C. H., on type of sizing machine. 1912, ii. 465.
- BROWN, C. S. V., on charcoal. 1915, ii. 235.
- BROWN, E., on determination of dust in blast-furnace gases. 1913, ii. 580.
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- BROWN, E. C., on utilisation of blast-furnace slags. 1916, ii. 421.
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- BROWN, ERNEST RICHARD, elected member. 1918, ii. 2.
- BROWN, FRANCIS EDWIN, elected member. 1918, i. 2.
- BROWN, G., on signalling in collieries. 1912, ii. 517.
- BROWN, G. H., on heat conductivity of refractory materials. 1915, i. 500.
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- BROWN, G. T., on management of mining estates. 1916, i. 300.
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BROWN, J. H.—

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on action of steam on iron. 1911, ii. 651.

on corrosion of iron and steel. 1911, ii. 650.

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- BUBNOFF, S. VON, on coal resources of Russia. 1921, ii. 348.
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- BUCK, R., on utilisation of blast-furnace gases. 1911, ii. 544; 1912, i. 500.
- BUCKLEY, JAMES HENRY, elected member. 1921, i. 2.
- BUCKLEY, J. P., on calorimetry. 1920, i. 685.
- BUCKLEY, W. H., on blast-furnace construction. 1920, i. 704.
- BUDERUS, C., on methods of testing moulding sand. 1913, i. 613.
- BUDGE, G. D., on machine-mining practice in South Wales. 1914, i. 624.
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- BULLE, G., on coal-dust firing in ironworks. 1921, ii. 346.
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- BULLENS, D. K., on armour-plate manufacture. 1914, i. 699.
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- BULLOCK, FRANK HARRISON, elected member. 1913, i. 2.
- BUMBY, H., briquetting iron ores. 1917, ii. 55.
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- BURGERS, FRANZ, elected member. 1913, i. 2.
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BURMAN, B. F., on blast-furnace coke. 1916, i. 315.

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BURNETT, GEORGE RICHARD, elected associate. 1917, i. 5.

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BURNS, C. H. M., on method of working coal. 1914, ii. 309.

BURNS, W. Z., elected member. 1920, i. 2.

BURNYEAT, WILLIAM JOHN DALZELL, elected member. 1912, ii. 5.

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BURR, F. L., on methods of iron ore mining. 1917, ii. 345.

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BURR, M., on deep-boring operations in Kent coalfield. 1914, i. 598.

BURR, W. H., on tests on a steel column with concrete filling. 1912, i. 566.

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- BURROWS, C. W., on magnetic properties of iron alloys. 1911 i. 658.
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- BURROWS, G. J., on corrosion of steel in water. 1912, i. 591.
- BURSTALL, F. W., on gas-engines. 1911, i. 563.
- BURSTALL, G. W., on producer-gas for power purposes. 1913, ii. 558.
- BURTON, NORMAN, elected member. 1913, ii. 4.
- BURTON, R. C., on examination of coal by X-rays. 1912, ii. 479.
- BURTON, TOM GEORGE HERBERT, elected member. 1919, ii. 2.
- BURY, A., on electrostatic deposition of flue-dust. 1921, i. 404.
- BURY, E., on alcohol recovery from coke-oven gas. 1920, i. 697.
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- BUSH, H. J., on Cottrell process of electrostatic separation. 1919, i. 651 ;
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- BUSHELL, CHARLES GEORGE, elected member. 1911, ii. 9.
- BUSHONG, F. W., on composition of petroleum. 1915, i. 519.
- BUSK, H. G., on geology of the Persian oil-fields. 1919, i. 642.
- BUSSE, A., on corrugation of rails. 1911, i. 655 ; 1913, i. 666.
- BUTCHER, E. W. R., on methods of working iron ore. 1913, i. 521
- BUTLER, E., on oil-fired furnaces for foundries. 1912, ii. 543.
- BUTLER, E. M., on iron industries of Jugo-Slavia. 1921, ii. 336.
- BUTLER, GEORGE BERNARD, elected member. 1918, i. 2.
- BUTLER, J. G., on history of iron. 1918, i. 496.
- BUTLER, J. S., on gob-fires. 1915, ii. 254.
- BUTLER, T. F., obituary notice of. 1914, i. 552.
- BUTLER, T. H., on coal-tar distillation. 1918, i. 485.
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- BUTTS, C., on coal in Virginia. 1914, i. 601.
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- BUTZ, G., on heat energy from the Bessemer process. 1915, ii. 277.
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- CALIAN, J., on osmondite in hypo-eutectic steels. 1912, i. 583.
- CALKINS, F. C., molybdenite in California. 1917, i. 286.
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- CAMPBELL, C. M., on carbonising boxes. 1921, ii. 386.
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- CAMPBELL, D. F., on electric furnaces. 1913, ii. 358.
on electric production of steel. 1911, ii. 592.
- CAMPBELL, E. D.—
Paper, "A contribution to the theory of hardening and the constitution of steel." 1914, ii. 1; reference to previous researches on subject, 1; historical development of research work on steel, 4; working hypothesis. 5; effect of chemical constitution on mechanical properties of steel, 5; differences in the products of solution of steels with varying carbon contents and heat treatment, 8; chemical constitution of carbides, 8; increase in electrical resistance, 9; conclusions, 10.—*Correspondence*: C. H. Desch, 11; W. H. Hatfield, 11; A. McCance, 13; E. D. Campbell (reply), 14.
Paper on "The influence of heat treatment on the specific resistance and chemical constitution of carbon steels." 1915, ii. 164. object of the paper, 164; work of previous investigators, 164; description of author's experimental work, 167.—*Discussion*: A. McCance, 178; E. D. Campbell (reply), 180.
Paper on "The influence of heat treatment on the thermo-electric properties and specific resistance of carbon steels." 1916, ii. 263.—*Correspondence*: H. M. Howe, 286; E. D. Campbell (reply), 286.
Paper on "The rate of change of 100° C. and at ordinary temperatures in the electrical resistance of hardened steel." 1918, ii. 421.
Paper on "The decarburisation of steel with hydrogen." 1919, ii. 407; apparatus used, 407; discussion of results, 413.—*Correspondence*: H. Le Chatelier, 415.

- CAMPBELL, E. D., on analysis of materials. 1921, i. 472.
 on constitution of steel. 1921, i. 463.
 on influence of methylene iodide on steel. 1912, ii. 621.
 on influence of heat treatment on steel. 1916, i. 372.
 on molecular constitutions of high-speed tool steels. 1919, i. 432.
 on production of sound ingots. 1912, ii. 62.
 on reactions in steels. 1921, i. 441.
 on resistance of iron solutions. 1917, i. 411.
 on the solution theory of steel. 1920, i. 752.
 on theory of hardening. 1914, i. 253.
 on transformations of steels. 1914, ii. 180.
- CAMPBELL, E. D., and WILLIAM C. DOWD—
Paper on "The influence of heat treatment on the electrical and thermal resistivity and thermo-electric-potential of some steels." 1917, ii. 251; experimental, 253.—*Correspondence*: C. H. Ridsdale, 263; E. D. Campbell (reply), 1918, ii. 427.
- CAMPBELL, E. D., and F. D. HASKINS—
Paper on "The effect of heat treatment on the colorimetric test for carbon in a 0.32 carbon steel." 1913, ii. 367; previous researches on subject, 370; author's experiments, 372; different methods of treatment, 375; results obtained, 378; progress in dissociation of dissolved carbides, 380; order of association of ionically dissociated carbides, 381; conclusions, 382.—*Correspondence*: E. H. Saniter, 383; J. E. Stead, 383; E. D. Campbell (reply), 384.
- CAMPBELL, E. D., and B. A. SOULE—
Paper on "Notes on rates of reaction in certain steels at 930° C." 1920, ii. 281.
- CAMPBELL, F. H., on separation of iron and manganese. 1913, i. 694.
- CAMPBELL, H. H., on acid Bessemer steel. 1916, ii. 428.
 on iron ore in France. 1916, ii. 374.
 on iron ore reserves of the world. 1917, i. 427, ii. 341.
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 on open-hearth practice in America. 1916, ii. 429.
 on steel industry of Europe after the war. 1916, ii. 472.
- CAMPBELL, H. L., on determination of cupola charges. 1921, i. 411.
 on heat treatment of special steels. 1920, i. 733.
 on manufacture of semi-steel. 1920, i. 711.
- CAMPBELL, J. M., on origin of laterite. 1917, ii. 338.
 on tungsten ores in Burma. 1919, i. 625; 1921, i. 371.
- CAMPBELL, J. R., on manufacture of basic coke. 1914, i. 603.
 on separation of sulphur from coal. 1920, i. 691.
- CAMPBELL, L. J., on corrosion tests of iron and steel. 1912, ii. 609; 1914, ii. 386.
- CAMPBELL, M. R., on analyses of American coals. 1917, i. 309.
 on coal in West Virginia. 1921, ii. 348.
 on origin of petroleum. 1915, ii. 243.
- CAMPBELL, W., on annealing of steel castings. 1914, ii. 355.
 on coal in Peru. 1921, i. 384.
 on constitution of cast iron. 1912, ii. 382.
 on hardening and annealing of steels. 1911, i. 633.
 on heat treatment of nickel steels. 1911, ii. 602.

- CAMPBELL, W., on metallography. 1911, ii. 634.
on microstructure of iron and steel. 1913, i. 678.
- CAMPBELL JOHNSTON, R. C., on iron ore in Canada. 1919, i. 616.
on petroleum in Canada. 1921, ii. 355.
- CAMPION, A., on annealing of steel castings. 1911, ii. 597.
on calcining fine iron ore. 1911, ii. 492.
on grading of pig iron. 1912, ii. 535.
on history of founding. 1914, i. 669.
on history of Scottish iron industry. 1911, ii. 554.
on influence of elements on cast iron. 1918, ii. 497; 1919, i. 682.
on iron ore in Scotland. 1911, ii. 470.
on manufacture of open-hearth steel. 1912, ii. 109.
on metallography and microstructure of metals. 1912, i. 582.
on reactions in the open-hearth furnace. 1913, i. 621.
on strength of oxy-acetylene welds. 1914, ii. 361.
on utilisation of blast-furnace slag. 1911, ii. 556.
- CAMPION, A., and J. M. FERGUSON—
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- CAMPION, EDWARD WINSLOW, elected member. 1920, i. 2.
- CAMPLANT, G., on coal in Italy. 1914, ii. 289.
- CANARIS, C., on cost-keeping in steelworks. 1914, i. 677.
on influence of pouring on quality of mild steel blooms. 1912, ii. 79, 81.
on manufacture of firebricks. 1911, ii. 498.
on open-hearth tilting furnaces. 1914, ii. 336.
on prevention of piping in steel ingots. 1912, i. 560, ii. 563; 1914, i. 682.
on testing of refractory materials. 1914, i. 589.
- CANAVAL, R., on magnesite in the Tyrol. 1912, ii. 489; 1913, i. 531.
- CANDY, A. M., on arc-welding. 1920, ii. 376; 1921, i. 444, ii. 393.
- CANFIELD, R. E., on low temperature distillation of sub-bituminous coal. 1920, ii. 328.
- CANTIENY, G., on recovery of primary tars. 1921, ii. 354.
- CANTLEY, C. L., on iron and steel industry of Nova Scotia. 1914, i. 755.
on iron ore in Newfoundland. 1916, i. 292.
- CANTLEY, T., on effect of the war on Canadian iron and steel industries. 1917, i. 425.
on iron ore in Nova Scotia. 1911, ii. 476.
on methods of mining iron ore. 1911, ii. 485.
- CANTRILL, T. C., on iron ore in Great Britain. 1919, ii. 458; 1920, ii. 306.
- CAP, J. A., on thermo-electric indication of strain as a testing method. 1912, ii. 382.
- CAPACCI, C.—
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- CAPLEN, TOM, elected member. 1912, i. 2.
- CAPP, J. A., on electric welding. 1919, i. 677.
- CAPPER, GEORGE HENRY, elected member. 1913, ii. 4.
- CAPPS, J. H., on coal distillation under pressure. 1918, i. 483.
- CAPPS, S. R., on coal in Alaska. 1912, i. 468; 1913, i. 541, ii. 542.
- CAPRON, A. J., on application of forging presses. 1914, i. 683; 1915, ii. 287.
 on manufacture and treatment of steel for guns. 1912, i. 332.
 on rolling-mill practice at home and abroad. 1917, ii. 299.
 on steam-engines for rolling-mills. 1912, i. 352.
- CAPRON, S. A., on moulding sand. 1911, ii. 567.
- CAPSTICK, NORMAN, elected associate. 1917, i. 5.
- CABACRISTI, C. F. Q., on magnesite in Venezuela. 1919, ii. 465.
- CARANFIL, N. G., on iron industry of Roumania. 1921, i. 406.
- CAREY, C. O., on strength of reinforced concrete beams. 1914, i. 712.
- CARHART, H. A., on welding. 1919, ii. 513.
- CARLISLE, C. G.—
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- CARLSON, W. W., on patterns. 1917, i. 351.
- CARLTON, THOMAS, on failure of boiler plates in service. 1917, ii. 167.
- CARNAHAN, R. B., jun., on open-hearth practice. 1912, ii. 554.
 elected member. 1911, ii. 9.
- CARNEGIE, ANDREW, obituary notice of. 1919, ii. 451.
- CARNEGIE, A. Q., on rolling-mill engines. 1911, i. 609.
- CARNEGIE, D., on forging presses. 1920, ii. 259.
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- CARNEGIE, EBENEZER, elected member. 1914, ii. xix.
- CARNELL, W. C., on acid-resisting iron. 1918, i. 545.
- CARNERA, L., on invar steel wires. 1916, i. 380.
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 on malleable cast iron. 1911, i. 605.
 on oxy-acetylene welding process. 1914, i. 697.
- CARNEY, FRANK D., elected member. 1918, ii. 2.
- CARO, N., on peat. 1911, i. 548.
 on peat-gas production. 1911, ii. 524.
- CARPENTER, A. W., on corrosion of iron. 1911, ii. 651; 1913, ii. 687.
 on test of a steel plate partly fused by electric current. 1911, i. 649.
- CARPENTER, H. B., on by-product coke-ovens. 1918, i. 483.

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Paper on "The growth of cast irons after repeated heatings." 1911, i. 196, Parts II, III, and IV; influence of phosphorus on growth, 197; influence of sulphur on growth, 198; influence of manganese on growth, 198; influence of dissolved gases on growth, 200; "growths" to be expected on heating grey cast irons to redness, 201; volume changes in cast irons when repeatedly heated *in vacuo*, 205; alloys of small or negligible growth, 214; tensile tests of bars subjected to 151 heats, 222; freezing-point determinations, 224; recommendations as to choice of alloys of negligible growth, 226; summary, 228.—*Discussion*: J. E. Stead, 230; J. O. Arnold, 236; E. H. Saniter, 237; T. Turner, 237; W. J. Foster, 238; A. E. Tucker, 240; C. A. Edwards, 241; W. H. Hatfield, 241; G. N. Huntley, 241.—*Correspondence*: E. Adamson, 241; C. A. Wingfield, 243; H. C. H. Carpenter (reply), 244. *See also* RUGAN, H. F.

Paper on "The critical ranges of pure iron." 1913, i. 315; introduction, 315; Benedicks' theory, 315; experimental conditions, 319; first series of curves, 320; second series, 322; conclusions, 326.—*Discussion*: W. Rosenhain, 327; J. O. Arnold, 328; Sir Robert Hadfield, 330; C. A. Edwards, 331; H. C. H. Carpenter, 332.—*Correspondence*: C. Benedicks, 333; G. K. Burgess, 335; J. H. S. Dickenson, 336; W. Guertler, 340; W. H. Hatfield, 344; H. M. Howe, 347; F. C. A. H. Lantsberry, 348; A. Lapworth, 349; H. Moore, 350; F. Rogers, 351; H. C. H. Carpenter (reply), 352.

Paper on "The hardening of metals, with special reference to iron and its alloys." *See* Edwards, C. A.

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on allotropy of iron. 1912, ii. 275; 1913, ii. 185.

on carburisation of iron. 1915, ii. 115; 1919, i. 442.

on cold flow of steel. 1913, i. 116.

on critical cooling velocities of chromium steel. 1916, i. 141.

on crystal growth of metals. 1920, ii. 391.

on determination of the line S.E. in the iron-carbon diagram. 1917, i. 199.

on German manganese ore requirements. 1916, i. 404.

on growth of cast iron. 1912, i. 558; 1917, i. 392.

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on hardening and tempering of high-speed tool steel. 1915, ii. 31, 36.

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on microstructure of commercially pure iron. 1917, ii. 347.

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on relations of carbon, chromium, and iron. 1911, i. 263.

on temperature influences on carbon and pig iron. 1911, ii. 101.

on tenacity and deformation of steel at high temperatures. 1913, i. 278.

on welding up of blowholes in steels. 1911, i. 75.

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Paper on "Some experiments on the reaction between pure carbon monoxide and pure electrolytic iron below the Al inversion." 1918, ii. 139; introduction, 139; experimental, 143; reagents, 146; conclusions from experiments, I-IV, 153; discussion of results, 181; conclusions, 190; references quoted, 191.—*Discussion*: J. E. Stead, 192; J. O. Arnold, 192; W. H. Hatfield, 192; N. T. Belaiew, 193; C. H. Desch, 193.—*Correspondence*: N. T. Belaiew, 194; J. E. Fletcher, 195; C. Coldron Smith and H. C. H. Carpenter (reply), 196.

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CARRICK, A., on moulding machines. 1918, i. 508.

CARRICK, R., on chilled castings. 1913, i. 614.

on heat treatment of cast iron. 1914, ii. 355.

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CARRINGTON, G., on heat-treatment furnaces. 1918, i. 526.

on non-metallic inclusions in steel. 1918, i. 302.

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CARRON, E. C., on estimation of nickel in ferro-nickel. 1912, ii. 620.

CAREUTHERS, R. G., on coal in Scotland. 1920, ii. 324.

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on geology of coal. 1917, ii. 363.

on iron ore in Scotland. 1917, ii. 339.

on oil shale in Scotland. 1913, ii. 551.

CARSON, H. Y., on corrosion of iron and steel. 1915, ii. 324; 1916, i. 394.

CARSON, WILLIAM, obituary notice of. 1916, i. 270.

CARTER, F. E., on by-product recovery from coal. 1916, i. 314.

CARTER, H. G., on dendritic steel. 1921, i. 466.

CARTER, H. R., on calorimetric testing of coal. 1913, i. 532.

CARTER, WALTER, elected member. 1916, i. 2.

CARTER, WILFRED GEORGE, elected member. 1920, ii. 3.

CARTIER, F., on iron ore handling appliances. 1913, ii. 517.

CARTOCETI, A., on estimation of sulphur. 1921, i. 471.

CARTON, L., on hardness of coke. 1911, i. 550.

CARY, A. A., on analysis of flue and furnace gases. 1913, i. 696.

CASEY, G. L., on electric smelting of iron ore. 1920, ii. 344.

CASSON, LOUIS JULIAN, elected associate. 1917, i. 5.

CASTELLI, G., on lignite in Italy. 1921, i. 384.

CASTIGLIONE, G. E. DI PALMA, on coal industry of the United States. 1916, ii. 470.

CASTLE, GEORGE CYRIL, elected member. 1918, i. 2.

CASTLEMAN, S. J., on coal in Canada. 1911, i. 546.

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Paper on "The applications of electricity in the metallurgical industry of Italy." 1911, ii. 215; production of steel or iron in the electric furnace, 215; production of pig iron in the electric furnace, 228; ferro-alloys, 231.

Paper on "The iron ore deposits of Piedmont." 1911, ii. 353; mines of Traversella, 355; mines of Cogne, 357.

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- CATANI, R., on iron ore in Italy. 1912, ii. 447.
- CATHCART, W. H., on burning of steel. 1915, i. 403; 1918, i. 526.
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- CATHERAL, A. P., on iron ore in Trinidad. 1913, i. 515.
- CATLETT, C., on composition of coal. 1912, i. 462.
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- CAULDWELL, F. W., on manganese ore in Russia. 1912, ii. 455.
- CAULEY, F. F., on value of gas for heat treatment. 1921, ii. 387.
- CAVE, GEORGE HERBERT, elected member. 1917, ii. 2.
- CAVE, H., on welding processes. 1911, i. 638; 1912, i. 552; 1914, ii. 360;
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- CAWLEY, FRANK BENNETT, elected associate. 1921, i. 5.
- CAYEUX, L., on iron ore in France. 1911, i. 514; 1913, i. 507; 1921, i. 372.
- CAZABAN, P., on coal in France. 1913, ii. 537.
- CELLAR, B., on blast-furnace construction. 1920, ii. 343.
- CESARO, G.—
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- CHABANIER, E., on analysis of iron and steel. 1920, i. 763.
- CHADSEY, S. B., on malleable cast iron. 1911, i. 604.
- CHALMERS, G., on iron ore deposits of Brazil. 1913, ii. 507.
- CHAMBERLAIN, H. S., on history of iron. 1915, ii. 266.
- CHAMBERLAIN, P. F., on shaft sinking. 1911, i. 526.
- CHAMBERS, AMBROSE, elected member. 1917, i. 2.
- CHAMBERS, E. V., on tar dehydration. 1916, i. 319.
- CHAMBERS, FREDERICK, elected member. 1914, i. 2.
- CHAMBERS, R. E., on mining iron ore. 1920, i. 668.
- CHAMBRIER, P. DE, on petroleum in Alsace. 1920, i. 700, ii. 333.
- CHAMPION, D. J., on steel rivets. 1912, ii. 579.
- CHANCE, E. M., on specific gravity of coal. 1911, i. 543.
- CHANCE, H. M., on coal washing. 1919, ii. 482.
 on low sulphur coal in Pennsylvania. 1919, ii. 474.
 on valuation of coal lands. 1913, ii. 573; 1915, i. 540.
- CHANCE, K. M., on recovery of potash from the blast furnace. 1918, i. 494.
- CHANCE, T. M., on low sulphur coal in Pennsylvania. 1919, ii. 474.
- CHANNEY, W., on manufacture of illuminating gas and furnace coke. 1913, ii. 547.
 on producer-gas from coke. 1917, ii. 379.
- CHANNING, J. P., on technical education in United States. 1911, ii. 680.
- CHANTRY, FRED, elected member. 1919, i. 2.
- CHAPIN, F. H., on American bolt and nut industry. 1921, ii. 392.
- CHAPLIN, G. P., on native methods of smelting iron ore. 1914, i. 654.
- CHAPMAN, C. M., on corrosion of iron and steel. 1911, ii. 649.
 on preservation of iron. 1911, i. 678.
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- CHAPMAN, JOHN HENRY, elected member. 1911, ii. 9.
- CHAPMAN, J. L., on corrosion of pipes. 1914, ii. 387.
- CHAPMAN, R. W., on hardening of steel due to strain. 1915, ii. 306.

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CHAPPELL, W. E., on electric equipment of collieries. 1911, ii. 527.

CHARBONNEL, LEON HENRI, elected member. 1919, ii. 2.

CHARITSCHKOFF, K. W., on origin of petroleum. 1912, ii. 493 ; 1913, i. 550.

CHARLES, F., on apparatus for gas analysis. 1911, ii. 669.

elected member. 1917, ii. 2.

CHARLTON, D. E. A., on iron ore mining in Latin America. 1921, ii. 338.

CHARLTON, W., on ventilation in collieries. 1912, ii. 574.

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on diffusion of hydrogen through iron and steel. 1912, i. 588 ; 1913, i. 675,

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on influence of coking temperature on crushing strength of coke. 1917, ii. 368.

on influence of heat treatment on physical properties of steel. 1913, ii. 659.

on influence of hot-deformation on the qualities of steel. 1919, i. 685.

CHARPY, G., on influence of silicon on expansion and transformation points of steel. 1913, ii. 682.

on influence of silicon on solubility of carbon in iron. 1914, i. 725.

on melting-point of coal. 1921, i. 385.

on microscopic cavities in steel ingots. 1920, i. 724.

on the oxidation of coal. 1917, i. 309.

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on rupture of steel rails. 1920, i. 745.

on separation of carbon as graphite in silicon steels. 1913, ii. 683.

on specifications for aircraft. 1919, i. 688.

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CHARPY, G., and A. CORNU-THENARD—

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CHASE, S. H., on cupola practice. 1911, i. 592.

CHATER, G. W., on tungsten mining in Burma. 1915, ii. 220.

CHAUDRON, G., on action of steam on iron. 1914, ii. 386.

CHAUTARD, J., on origin of petroleum. 1915, i. 518; 1916, i. 316, ii. 403.

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CHAUVENET, R., on blast-furnace calculations. 1912, i. 496; 1915, i. 545.

CHAUVENET, S. H., on Portland cement as a substitute for fireclay. 1913, i. 529.

CHEDLER, ROBERT BINDS, elected member. 1921, ii. 9.

CHEGWIDDEN, W. M., on sampling of blast-furnace slags. 1921, i. 408.

CHENEVEAU, C., on magnetic properties of manganese steels. 1917, ii. 445.

CHENEY, C. A., jun., on iron ore in the United States. 1915, ii. 218.

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CHEVASSUS, R., on apparatus for gas analysis. 1911, i. 690.

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COOPER, ARTHUR H., obituary notice of. 1914, i. 553.

COOPER, D. L., on gas-engines versus steam turbines. 1917, ii. 382.

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COOPER, EBENEZER ELIAS, obituary notice of. 1916, ii. 361.

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COPAUX, H., on utilisation of low-grade fuel. 1919, ii. 471.

COPE, B. G., on rock drills. 1911, i. 526.

COPE, W. C., on explosives and blasting. 1912, ii. 510; 1916, ii. 413.

COPEMAN, S. M., on use and properties of ferro chrome. 1914, i. 731; ii. 341.

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- CORBETT, E. E., on pickling steel. 1919, i. 680.
- CORBIAU, J., on multiple casting of small ingots. 1912, ii. 564.
- CORBINO, O. M., on specific heat of metals. 1912, ii. 607.
- CORDEN, S., on core-making. 1921, i. 415.
- CORDES, R., on smelting low-grade manganiferous ore. 1917, ii. 390.
- CORK, J. A., on utilisation of surplus gas. 1919, ii. 481.
- CORLETT, G. S., on electrical equipment of collieries. 1917, ii. 383.
- CORMACK, J. D., on combustion chart for checking analyses of gas. 1914, i. 749.
- CORNELL, W., on separation of chromium and manganese. 1913, ii. 701.
- CORNELL, S., on blast-furnace calculations. 1915, i. 545.
- on coating of metals. 1921, i. 449.
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- CORNELOUP-KORGANIANZ, T., on Caucasian oil industry. 1913, i. 552.
- CORNING, CHRISTOPHER, elected member. 1913, i. 2.
- CORNTHWAITE, HAYDN, elected member. 1917, ii. 2.
- CORNU-THENARD, A., on development of critical points of iron by addition of silicon. 1913, ii. 683.
- on impact testing machines. 1914, i. 707.
 - on impact tests. 1917, ii. 437; 1920, i. 742; 1921, i. 456.
 - on influence of silicon on expansion and transformation of low-carbon steel. 1913, ii. 682.
 - on influence of silicon on solubility of carbon in iron. 1914, i. 725.
 - on separation of carbon as graphite in silicon steels. 1913, ii. 683.
- elected member. 1921, ii. 9.
- Paper* on "Researches on the iron, silicon, and carbon alloys." *See* G. Charpy.
- Paper* on "New experiments on shock tests and on the determination of resilience." *See* Charpy, G.
- CORRAL, J. I. DEL, on iron ore in Cuba. 1912, i. 440.
- CORSE, W. M., on foundry costs. 1913, ii. 610.
- CORTESE, E., on coal deposits of Ogliastra. 1911, ii. 507.
- on iron ore in Italy. 1911, ii. 472.
- CORVISIER, E., on haulage in collieries. 1913, i. 574.
- COSTE, E., on origin of petroleum. 1912, i. 472; 1915, i. 519.
- COSTE, J. H., on thermometry. 1913, i. 533.
- COSTER, A. V., on Crossley's open-hearth suction-gas plant. 1914, i. 617.
- on gas-engines. 1913, i. 567; 1914, i. 620.
- COTTAM, HARRY DURHAM, elected member. 1913, i. 2.
- COTTE, on explosions in collieries. 1911, i. 574.
- COTTER, G. DE P., on coal in Upper Burma. 1915, i. 508.
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- COTTRELL, F. G., on helium from natural gas. 1919, ii. 479.
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- COULBY, H., on transportation of iron ore. 1914, i. 582.

- COULSON, J., on electrolytic pickling and its effects on physical properties of steel. 1919, i. 680.
- COULSON, R. H. A., on handling material in ironworks. 1916, i. 333.
- COUND, S. R., on tinplate rolling-mill practice. 1915, i. 592.
- COURLOT, H., on explosions in collieries. 1911, i. 574.
- COURNOT, J., on annealing of electrolytic iron. 1921, i. 442.
- COURT, J., on miners' nystagmus. 1913, ii. 573.
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- CRABTREE, F., on sulphur in coal. 1920, i. 691.
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- CRAFTS, W. N., on manufacture of electric steel. 1914, ii. 341.
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- CRAMP, G. B., on coke-oven gas reheater. 1920, i. 696.
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- CRANE, W. R., on coal in Alaska. 1915, i. 510.
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- CRANFIELD, W., on thermal efficiency of gaseous fuel. 1913, ii. 534.
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- CRAVEN, M. B., on calorific value of coal. 1921, ii. 345.
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 CROOK, SYDNEY, elected member. 1918, i. 2.
 CROOK, T., on properties and composition of magnesite. 1919, i. 627.
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 CROOKS, H. F., on coal industry of Belgium, France, and Germany. 1921, i. 383.
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- CROSBY-JONES, F., on preservation of iron and steel. 1914, i. 739.
- CROSLAND, J. F. L., on failure of a crank-shaft. 1912, i. 564.
- CROSS, B. J., on pulverised coal. 1920, ii. 322.
- CROSS, R., on cracking of petroleum in the liquid state. 1917, ii. 372.
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- CROSSFIELD, A. S., on determination of flash-point of petroleum. 1913, ii. 555.
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- CROSSLEY, ALLEN EWART, elected associate. 1921, i. 5.
- CROSSLEY, SIR W. J., obituary notice of. 1911, ii. 452.
- CROUCH, C. H., on lignite as fuel in gas-producers. 1913, i. 564.
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- CROWDY, THOMAS, elected member. 1919, i. 2.
- CROWE, E., on cost-keeping in steelworks. 1914, i. 677.
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- CROZE, W. W. J., on iron ore in the United States. 1911, i. 520.
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- CRUIN, J. R., on apparatus for estimation of fire-damp. 1914, i. 631.
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- CUMMINGS, A. C., on rupture of cast iron in contact with acid. 1919, ii. 517.
- CUMMINGS, LLOYD ANDERSON, elected member. 1916, ii. 1.
- CUNLIFFE, J., on use of pulverised fuel. 1918, ii. 448.
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- CUNNINGHAM, E. A., on determination of sulphur in coal. 1911, ii. 668.
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- CUNNINGHAM, WILLIAM, elected member. 1917, ii. 2.
- CUNNINGHAM, W. H., on gases in mines. 1912, i. 488.
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- CURRAN, F. V., on carnotite deposits of Colorado. 1912, i. 442.
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- CURRAN, JAMES JOSEPH, elected member. 1920, ii. 3.
- CURRY, NICHOLAS, elected member. 1920, i. 2.
- CURTIS, A. H., on manganese ores. 1920, i. 672.
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- CUSTER, E. A., on cupola practice. 1911, i. 591.
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- CUTHILL, JAMES, elected member. 1918, i. 2.
- CUTLER, F. G., on use of turbines in iron and steel industry. 1914, ii. 322, 339.
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- CUTTER, L. E., on strength of gear teeth. 1916, i. 384.
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- CUVELETTE, E., on shaft-sinking. 1911, i. 564.
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- DACH, T., on Fohr-Kleinschmidt process for briquetting coal. 1915, i. 541.
- DAELEN, W., on effect of war on British and French iron industries. 1916, ii. 472.
- DAEVES, K., on chromium tungsten steels. 1921, ii. 414.
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- DAHLMANN, G., on utilisation of blast-furnace slag. 1911, ii. 557.
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- DALBURG, F. A., on iron ore in the Phillipines. 1915, i. 482.
- DALBY, W. E., on elastic properties of metals. 1921, i. 457.
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- DALE, N. C., on manganese ore in Newfoundland. 1917, i. 284.
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- DAMOUR, E., on influence of heat and of fumes on refractory bricks. 1914, ii. 281.
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- DANFORD, M. O., on lighting of collieries. 1911, ii. 535.
- DANFORTH, C. W., on sampling of steel billets. 1913, i. 689.
- DANFORTH, G. L., on open-hearth furnace regenerators. 1916, ii. 429.
- DANHEISER, M. B., on estimation of nickel in steel. 1921, i. 471.
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- DANIELS, E. H., on use of fuel oil. 1920, i. 701.
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- DANIELS, FRED. HARRIS, obituary notice of. 1913, ii. 478.
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- DANKS, JOSEPH WILLIAM, elected member. 1918, i. 2.
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- DANN, E., on iron deposits of Bilbao. 1913, ii. 498.
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- DANSE, L. A., on heat-treatment of motor parts. 1918, ii. 485.
- DANTIN, C., on manufacture of shells. 1916, i. 362.
- DANVERS, ALFRED ERNEST, elected member. 1918, i. 2.
- DANZER-ISCHER, A., on corrosion of rails in tunnels. 1912, ii. 613.
- DARBY, J. H., on distillation of tar. 1913, ii. 67.
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- D'ARCAMBAL, E. H., on hardening of high-speed steel. 1921, i. 441.
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- DARLEY, W. J., on coal-handling. 1914, ii. 314.
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- DARLING, THE HON. MR. JUSTICE, speech at Dinner by. 1914, i. 548.
- DARLING, S. M., on coal briquetting. 1915, ii. 256; 1917, i. 336.
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- DARLINGTON, C. J., on occluded gases in ferrous alloys. 1918, i. 518.
- DARBAH, W. A., on manufacture of electric ferro alloys. 1920, i. 708.

- DARRIN, M., on passivity of iron. 1912, i. 596.
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- DARTON, N. H., on inflammable gases in coal. 1916, i. 326.
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- DAT, A., on casting in chills. 1921, ii. 372.
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- DAVENPORT, E. S., on malleable cast iron. 1921, i. 451.
- DAVENPORT, L. D., on methods of working iron ore. 1912, ii. 461; 1913, i. 521.
- DAVENPORT, R. W., on pyrometry. 1911, i. 537.
- DAVEY, EDWARD, elected member. 1912, i. 2.
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- DAVEY, G. H., obituary notice of. 1912, i. 409.
- DAVEY, W. P., on application of radiography to the examination of steel. 1915, i. 596; ii. 323.
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- DAVIDENKOF, N., on impact tension testing. 1912, ii. 381.
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- DAVIDSON, J., on coking tests of coal. 1912, ii. 488.
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- DAVIDSON, THOMAS REGINALD, elected member. 1919, ii. 2.
- DAVIDSON, W. B., on carbonisation of coal. 1912, ii. 489.
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- DAVIES, A. M., on coal in Buckinghamshire. 1913, i. 536.
- DAVIES, C., on estimation of sulphur. 1912, i. 609.
- DAVIES, C. E., on power requirements in rolling-mills. 1916, ii. 438; 1918, ii. 480.
- DAVIES, D., on geology of coal. 1911, i. 541.
- DAVIES, D. J., on mineral resources of Newfoundland. 1921, i. 373.
- DAVIES, E. F., on heat treatment furnaces. 1921, i. 437.
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- DAVIES, HAROLD RHYS, elected member. 1914, i. 2.
- DAVIES, HARRY, elected member. 1917, i. 2.
- DAVIES, HECTOR LEIGHTON, elected member. 1918, ii. 2.
- DAVIES, J. H., on welding processes. 1919, i. 676.
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- DAVIES, LESLIE JOHN, elected member. 1912, ii. 5.
- DAVIES, LLEWELLYN, elected member. 1920, ii. 3.
- DAVIES, LLEWELLYN JOHN, elected member. 1921, i. 2.
- DAVIES, R. S., on analysis of ferro-boron. 1912, i. 610.
- DAVIES, STANLEY, elected member. 1917, ii. 2.

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- DAVIES, STANLEY RICHARD, elected member. 1912, i. 2.
- DAVIES, THOMAS FRANCIS, elected member. 1913, i. 2.
- DAVIS, C. A., on brown-coal briquetting. 1914, ii. 315.
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- DAVY, JOHN FRANK, elected member. 1917, ii. 2.
- DAVY, L., on early French industry. 1913, ii. 588.
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- DAWKINS, CROWELL T., elected member. 1912, i. 2.
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- DAWSON, A. K., on electric welding. 1921, i. 445.
- DAWSON, W., on sound steel ingots. 1915, i. 72.
- DAWSON, W., JUN., on mineral statistics of Spain. 1911, i. 699.
- DAWSON, WILFRED JOHN, elected member. 1915, ii. 2.
- DAWTRY, EDGAR, elected member. 1911, ii. 9.
- DAY, A. L., on melting-points of refractory materials. 1911, ii. 496.
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- DEAN, J. G., on potash as a blast-furnace by-product. 1919, i. 651.
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- DEANE, N., on preparation of enamels. 1921, ii. 416.
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- DE BRUYN, C. A. L., on passivity of iron. 1916, i. 397.
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- DEISS, E., on estimation of vanadium. 1911, ii. 659.
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- DEJEAN, P., on classification of nickel and manganese steels. 1917, ii. 448.
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- DELADRIÈRE, G., on metallurgical coke. 1921, i. 387.
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- DELBROCK, M., on effect of impact on winding ropes. 1920, ii. 384.
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- DEMOREST, D. J., on estimation of chromium and vanadium in steel. 1913, i. 691.
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- DEMOZAY, LUCIEN, elected member. 1919, i. 2.
- DEMPSEY, H. B., on design of forge furnaces. 1920, i. 726.
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- DENNISON, L. G., on American foundries. 1912, i. 524.
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 DESLANDES, L. E., elected member. 1921, i. 2.
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- DEWEY, H., on iron ore in England. 1919, ii. 458; 1920, ii. 306.
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- DICKENSON, ERNEST LAWRENCE, elected member. 1912, i. 2.
- DICKENSON, J. H. S., on brittleness in nickel-chrome and other steels. 1920, i. 619.
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- DICKINSON, H. C., on an aneroid calorimeter. 1915, i. 503.
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- DICKSON, S., on mechanicalising analysis. 1911, i. 370.
- DIDIER, L., on coal in the Rhine district. 1913, i. 537.
- DIECKMAN, T., on arsenides of iron and manganese. 1912, i. 588, 609.
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- DIECKMAN, W., on iron ore in Morocco. 1913, i. 510.
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- DIEDRICH, GUSTAF HARRY, elected member. 1913, i. 2.
- DIEFENTHALER, A., on piping in ingots. 1913, i. 636.
- DIEFENTHALER, O., on estimation of vanadium. 1911, ii. 659.

- DIEGEL, C., on corrosion of iron pans for galvanising. 1916, i. 396
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- DIEHL, A. N., on gas-cleaning. 1914, i. 305.
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- DIERFELD, on vanadium-steel. 1911, ii. 628.
- DIETHELM, B., on estimation of carbon and sulphur. 1911, i. 683.
- DIETHER, J., on tinplate rolling. 1913, ii. 645.
- DIETRICH, H. H., on equipment of coke-ovens. 1917, ii. 370.
- DIETRICH, R., on duplex open-hearth furnaces. 1913, i. 620.
- DIETZ, on cooling deep workings in collieries. 1911, ii. 532.
- DIEUDONNÉ, E., on electric furnaces. 1921, ii. 378.
- DIEFFIN, F. E., on the standardisation of aeroplane parts. 1917, ii. 440.
- DIGBY, W. P.—
Paper on "Some studies of welds." See LAW, E. F.
- DILLER, H. E., on air furnace iron. 1921, i. 416.
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- DILLNER, G., on coal supplies of Sweden. 1913, ii. 538.
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- DINHAM, C. H., on geology of coal. 1917, ii. 363.
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- DINOIRE, E., on electricity in mines. 1911, i. 566.
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- DITMAS, F. I. L., on coal in India. 1911, i. 544; 1913, i. 708.
- DITTMUS, E. J., on calorimetry. 1915, ii. 229.
- DITTRICH, M., on estimation of sulphur in pyrites. 1914, i. 746.
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- DITTUS, E. T., on production of molybdenum in the electric furnace. 1911, ii. 592.
- DITZ, H., on deposition of carbon in blast-furnace walls. 1913, i. 580.
- DIVIŠ, J., on measurement of stresses. 1911, ii. 632.
- DIX, E. H., on impact tests. 1920, i. 742.
- DIXIE, E. A., on hardening furnaces. 1912, i. 547.
- DIXON, ARTHUR THOMAS, elected member. 1914, i. 2.
- DIXON, C., on methods of mining iron ore. 1912, i. 445, ii. 461.
- DIXON, H. B., on dust for preventing explosions in collieries. 1913, ii. 571.
- DIXON, HARRY WILLIAMSON, elected member. 1912, ii. 5.
- DIXON, J. L., on electric steel practice. 1917, ii. 407.

- DIXON, S. M., on mine supports. 1913, i. 569.
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- DIXON, SYDNEY YORSTON, elected member. 1921, i. 2.
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- DOAK, S. E., on agglomeration of iron ore in rotary kilns. 1916, i. 301.
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- DODGE, J. M., on history of high-speed steel. 1915, ii. 328.
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- DOERR, H. E., on influence of forging on specific density of steel. 1919, i. 673.
- DOHNER, G. K., on effect of cold twisting on properties of mild steel bars. 1917, i. 400.
- DOLBEAR, S. H., on chrome ore in California. 1915, i. 488.
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- DOLCH, M., on utilisation of brown coal. 1921, ii. 345.
- DOLEZAL, E., on mine surveying. 1911, ii. 486.

- DOMBRAIN, H. A. A., on Schneider gas-engine. 1921, ii. 358.
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- DOMIAN, L., on coal in Turkey. 1916, ii. 397.
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- DOMPÉ, L., and F. S. PUCCI—
Paper on "The present state of the iron industry in Italy." 1911, ii. 239. The production of pig iron, wrought iron, and steel; introduction, 239; notes on works, 242; production of pig iron, 243.
- DONALD, DAVID PATRICK, obituary notice of. 1913, ii. 478.
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- DONALDSON, F., on mine drainage. 1914, i. 625.
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- DONALDSON, J., on influence of vanadium on cast iron. 1918, ii. 497.
- DONALDSON, J. W.—
Paper on "Gases occluded in alloy steels." C.S.M., 1916, vii. 41.
on gases occluded in steels. 1921, i. 463.
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awarded Carnegie Research Grant. 1914, i. 24.
- DONALDSON, PETER, obituary notice of. 1913, ii. 478.
- DONATH, E., on break-outs in blast furnaces. 1914, i. 638.
on coking coal. 1914, i. 602.
on composition of coal. 1912, ii. 478.
on composition of graphite. 1915, i. 500, ii. 226.
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on origin of coal. 1911, i. 541.
- DONNER, G., on use of producer gas in open-hearth furnaces. 1920, i. 715.
- DONOVAN, W., on iron sands of New Zealand. 1917, ii. 341.
- DOONAEV, SERGIUS C., elected member. 1914, ii. xix.
- DORE, ALAN SYDNEY W., elected member. 1911, ii. 9.
- DORMAN, RICHARD BROOKE, elected member. 1920, i. 3.
- DORNHECKER, K., on specific volume of iron carbon alloys. 1915, i. 621.
- DORRANCE, C., JUN., on coal briquettes. 1911, ii. 538.
- DORRINGTON, WALTER, elected member. 1921, i. 2.
- DORSEY, S. W., elected member. 1913, i. 2.
- DOSCH, A., on heat value determinations of coal. 1914, i. 591.
- DOTY, J. W., on shaft-sinking. 1917, i. 330.
- DOTY, R. J., on moulding of steel castings. 1921, i. 415.
- DOUBS, F., on electric production of steel. 1911, ii. 591.
- DOUGHERTY, G. T., on estimation of vanadium. 1915, ii. 331.
- DOUGILL, G., on corrosion of iron. 1914, i. 733.
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- DOUGLAS, A., on coking tests of coal. 1913, i. 545.
- DOUGLAS, JAMES, obituary notice of. 1919, ii. 453.
- DOVEL, J. P., on foundry pig iron. 1921, i. 403.
- DOW, D. B., on recovery of gasoline from natural gas. 1920, ii. 339.

- DOW, HAROLD PERCY, elected member. 1913, ii. 4.
- DOWD, A. A., on hardening steel in the forge. 1915, i. 583.
- DOWD, WILLIAM C.—
Paper on "The influence of heat treatment on the electrical and thermal resistivity and thermo-electric-potential of some steels." See CAMPBELL, EDWARD D.
- DOWLING, D. B., on coal in Canada. 1911, i. 546, ii. 509; 1915, ii. 234; 1917, ii. 366.
 on coal resources of the world. 1915, i. 658.
 on natural gas in Canada. 1917, ii. 377.
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- DOWN, T. A., on tungsten in Portugal. 1916, i. 297.
- DOWNES, C. R., on preservation of mine timber. 1913, ii. 564.
- DOWNES, WILLIAM, elected member. 1917, ii. 2.
- DOWSON, J. E., on gas-producers. 1911, i. 559.
- DOXSEY, W. S., on use of steel in aeroplane construction. 1917, i. 408.
- DOZY, C. M., on formation of coal. 1911, ii. 506.
- DRAKELEY, T. J., on coal washing. 1918, i. 487.
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- DRAPER, J. M., on coal washing. 1919, ii. 482.
- DRESLER, H., on manufacture of slag bricks. 1914, i. 652.
- DRESS, G. W., on defects in finished rolled steel. 1917, ii. 439; 1918, i. 520.
 on transverse tests and influence of structure. 1917, ii. 437.
- DRESSER, J. A., on asbestos resources of Quebec. 1915, i. 502.
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- DRESSLER, C., on fuel saving in Dressler kiln. 1921, i. 381.
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- DREUX, A., on iron ore in France. 1915, i. 480.
- DREVES, E., on Gröndal briquetting process. 1914, i. 585.
- DREW, W. N., on the rectification of benzol. 1917, i. 318.
- DREWS, K., on winding-engines. 1911, i. 569.
- DRIESEN, J., on determination of the critical points in steel by observation of the expansion. 1916, ii. 461.
 on dilatation of steel. 1918, i. 538.
 on rates of expansion of steels containing varying percentages of carbon. 1914, i. 714.
- DRISCOLL, LAURENCE, elected member. 1920, i. 3.
- DRON, R. W., on coking coal in Scotland. 1918, ii. 452.
- DROUGININE, G., on atomic weight of nitrogen. 1911, i. 690.
- DROUOT, H., on use of pulverised fuel. 1921, i. 381.
- DROSNE, P., on elasticity and tenacity. 1921, ii. 402.
- DRUMMOND, THOMAS J., elected member. 1912, i. 2.
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- DRUSHEL, W. A., on estimation of sulphur in gas. 1916, ii. 469.
- DRYBURGH, ALEXANDER PETER, elected member. 1919, i. 3.
- DRYSDALE, C. W., on origin of iron ore. 1916, ii. 374.
- DUB, G. D., on preparation of crucible graphite. 1919, ii. 465; 1921, i. 379.
- DUBOIS, A., on protective coatings for iron. 1914, i. 738.
- DUCKHAM, SIR A., on coal as a source of oil fuel supply. 1921, i. 380.

- DUCKHAM, SIR A., elected member. 1919, ii. 2.
speech at Dinner by. 1919, i. 610.
- DUCRU, on structure of titanium and aluminium alloys. 1911, ii. 638.
- DUDDING, B. P., on pyrometry. 1915, i. 504.
- DUDLEY, B., JUN., on heat conductivity of refractory bricks. 1915, i. 500.
- DUDLEY, P. H., on fissures in steel rails. 1914, ii. 373; 1916, ii. 439.
on magnetic surveys on rails. 1920, i. 751.
on piping and segregation of steel. 1913, i. 632; 1915, i. 87.
on specifications for steel rails. 1911, i. 655.
on tests on steel rails. 1911, ii. 618; 1912, ii. 382; 1913, i. 664.
- DUFF, A. B., on by-product recovery. 1913, i. 567.
- DUFFIELD, JAMES, obituary notice of. 1915, i. 458.
- DUFFY, L.—
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- DUGLAS, W., on the peat fuel industry. 1915, i. 513.
- DUISBERG, C., on properties of alloy steels and alloys. 1913, ii. 665.
- DULIEUX, E., on coal in Canada. 1911, i. 545.
on iron ore in Canada. 1912, ii. 450; 1914, i. 572.
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- DUMBLE, E. T., on origin of petroleum. 1914, i. 609.
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- DUMONT, A., on forging practice. 1920, i. 727.
- DUNAIME, P., on prevention of coal-dust explosions. 1914, i. 629.
- DUNAJ, K., on petroleum in Austria. 1915, ii. 243.
- DUNBAR, H. W., on foundry economics. 1917, i. 360.
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- DUNCAN, F. M., on design of photo-micrographic apparatus. 1920, i. 757.
- DUNCAN, H. M., on mechanical properties of turbine steel. 1920, i. 744; ii. 381.
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- DUNDERDALE, R. J., on light steel castings. 1920, ii. 354.
- DUNHAM, M. K., on oxy-acetylene welding. 1916, i. 366.
- DUNKELBERG, on history of mining. 1913, ii. 589.
- DUNLOP, R., on iron ore in South Africa. 1915, ii. 217.
- DUNN, J. J., on manufacture of seamless-steel boiler tubes. 1912, ii. 569.
- DUNN, J. T., on melting point of coal ash. 1918, i. 479.
- DUNN, W. M., on winding-gear at South Kenmuir Colliery. 1913, ii. 568.
- DUNNACHIE, JAMES, JUN., on properties of refractory materials. 1917, i. 53.
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- DUNSTAN, A. E., on petroleum refining. 1921, i. 383.
- DUNSTAN, CHARLES A., elected member. 1920, i. 3.
- DUNSTAN, W. R., on coal in Nigeria. 1914, ii. 289.
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- DUPERRON, O., on fuel economy. 1919, i. 637.
- DUPUIS, J., on use of coke-oven gas. 1921, ii. 376.

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on influence of various metals on thermo-electric properties of iron-carbon alloys. 1914, i. 714.

on tests of steel at high temperature. 1921, ii. 400.

on thermo-electric properties of iron-nickel-carbon alloys. 1913, i. 670.

elected member. 1921, ii. 9.

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DURAND, OLIVER CHARLES, elected member. 1918, i. 2.

DURBAN, T. E., on uniform boiler specifications. 1914, i. 712.

DURLEY, R. J., on coal in Canada. 1912, ii. 483.

on gas-producer tests of Canadian coal. 1912, ii. 483.

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DURR, on utilisation of low-grade fuel. 1911, ii. 504.

DURRAN, RICHARD THOMAS, elected member. 1918, ii. 2.

DURRER, R., on application of metallography in foundries. 1918, i. 554.

on disintegration of slag. 1917, ii. 396.

on electric shaft furnace. 1921, ii. 365.

on electrostatic separation of flue-dust. 1920, i. 707.

on Söderberg electrode. 1921, i. 425.

DU TOIT, A. L., on iron ore in South Africa. 1915, ii. 216.

on oil shales in Natal. 1917, i. 321.

DUTTON, C. B., on petroleum products. 1916, ii. 406.

DUTTON, W. F., on vanadium poisoning. 1911, ii. 628.

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DWIGHT, A. S., on Dwight-Lloyd sintering process. 1912, ii. 465.

DWIGHT, H. B., on steel conductors for electric transmission lines. 1917, i. 409.

DWYER, P., on gas-engine castings. 1921, i. 414.

on machine moulding. 1920, i. 712.

DYCKERHOFF, A., on economics of roll trains. 1921, i. 434.

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DYER, E. I., on flow of oil through pipes. 1914, ii. 302.

DYER, F. C., on methods of concentrating molybdenum ores. 1918, i. 473.

DYER, Y. A., on cast-iron pipes. 1917, i. 353.

- DYER, Y. A., on cupola practice. 1921, ii. 369.
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- DYKEMA, W. P., on recovery of gasoline from natural gas. 1918, ii. 458; 1920, ii. 330.
- DYSON, H. K., on tests of steel bars in concrete. 1921, i. 458.
- DYSON, W. H., on use of silico-calcium in refining steel. 1911, i. 618.

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- EAGAN, D. F., on core-making machines. 1911, i. 603.
- EAGAN, J. H. D., on steel castings. 1916, ii. 424.
- EAKIN, H. M., on coal in the United States. 1911, ii. 509.
 on iron ore in United States. 1916, i. 293.
- EARHART, R. F., on the viscosity and specific heat of natural gas. 1917, i. 327.
- EASTAUGH, F. A., on preparation of samples of coke ash. 1915, ii. 335.
- EASTHAM, J. H., on foundry patterns and moulding. 1912, i. 519.
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- EASTON, H. D., on coal in Kentucky. 1913, i. 542.
- EASTON, W. H., on the Heroult electric furnace. 1919, i. 665.
- EATON, G. M., on electric locomotives for mine haulage. 1915, i. 535.
- EATON, J. T., on plate mill and peak load relation. 1920, i. 728.
- EATON, L., on slushing in iron ore mining. 1921, ii. 338.
- EAVENSON, H. N., on coal-dust explosions. 1915, i. 538.
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- EBELING, a new explosive on. 1912, ii. 459.
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- EBRIGHT, H. C., on manufacture of tubes. 1921, i. 446.
- EBY, E. E., on roller-bearings for rolling-mill tables. 1918, ii. 479.
- EBY, J. H., on problems in open pit mining. 1915, i. 493.
- ECHEGARAI, N.—
Paper on "Iron ore resources of Chili." See VATTIER, C.
- ECKEL, E. C., on cement and iron industries. 1911, ii. 680.
 on concentration of iron ores. 1913, i. 523.
 on geology of iron ore. 1913, ii. 495.
 on iron ore in United States. 1912, ii. 642; 1913, ii. 506.
 on utilisation of blast-furnace slag. 1913, ii. 590.
 on valuation of ore reserves. 1913, i. 522.
- ECKELMANN, L. E., on phosphate coatings for rust-proofing iron. 1920, i. 760.
- ECKERMAN, H. V., on producer-gas from wood waste. 1918, ii. 460.
- ECKERMAN, O. W. H. VON, on melting of ferro-manganese. 1914, ii. 229.
 elected member. 1914, i. 2.
- ECKHARDT, A., on subsidence. 1914, i. 622.
- ECKMANN, S. H., on comparison of steam and electrical rolling-mills. 1913, i. 638.
- EDDINGTON, F. T., on iron ores of the world. 1920, i. 672.
- EDDY, L. H., on desulphurisation of blast-furnace gases. 1912, ii. 524.
- EDE, HENRY EDWARD, elected member. 1912, ii. 5.
- EDELEAND, L., on refining crude petroleum. 1915, i. 524.

- EDEN, E. M., on endurance tests. 1914, i. 705.
on stresses in steel. 1911, ii. 612.
- EDERT, H., on tensile tests. 1921, ii. 400.
- EDGAR, J., on casting propeller brackets. 1919, ii. 493.
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- EDGCOMBE, WILLIAM EDWARD, elected member. 1911, i. 2.
- EDGERTON, C. T., on manufacture and testing of springs. 1919, i. 676.
- EDHOLM, C. L., on the Irwin meteorites. 1914, i. 578.
- EDMISTON, J. A. C., on control of combustion. 1921, i. 72.
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elected member. 1917, i. 2.
- EDSALL, H. J., on foundry equipment. 1911, ii. 562.
- EDSON, R., on preparation of metallic vanadium. 1916, i. 400.
- EDWARDS, ALFRED, elected member. 1918, ii. 2.
- EDWARDS, ARTHUR ROWLAND, elected member. 1918, i. 2.
- EDWARDS, C. A., on Brinell hardness and tenacity factors of heat-treated special steels. 1915, i. 135.
on chemical relations of iron, vanadium and carbon. 1912, i. 230.
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on growth of cast iron. 1911, i. 241.
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on hardness of quenched metals. 1914, ii. 368 ; 1915, ii. 305.
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on influence of temperature on carbon and pig iron. 1911, ii. 103.
on influence of mechanical strain on structure of metals. 1915, ii. 301.
on iron and nitrogen. 1912, ii. 231.
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on magnetic and mechanical properties of manganese steel. 1914, i. 130.
on microstructure of steel. 1911, i. 662.
on nature of solutions. 1912, i. 585.
on oxygen enrichment of blast. 1913, i. 583 ; ii. 231.
on phosphorus in iron and steel. 1915, i. 189.
on relations of carbon, chromium, and iron. 1911, i. 262.
on relation between cutting efficiency and hardness of tool steel. 1916, i. 105.
on resistance of metals to penetration under impact. 1918, ii. 491.
on Roentgen spectrographic investigation of iron and steel. 1921, i. 332.
on solubility of cementite in hardenite. 1912, i. 243.
on transformations of steel during heat treatment. 1911, ii. 57.
- EDWARDS, C. A., and H. C. H. CARPENTER—
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Paper on "The effect of chromium and tungsten upon the hardening and tempering of high-speed tool steel." 1915, ii. 6; reference to Professor Carpenter's investigation, 6; views of F. W. Taylor on Professor Carpenter's results, 7; analysis of steels used by authors in present investigation, 8; hardness data, 10; hardness results for steels with constant chromium content, 12; hardness results for steels with constant percentage of tungsten, 13; effect of initial hardening temperature, 20; microstructures, 24; hardness and specific gravity, 25; conclusions, 29; references, 30. *Discussion*: H. C. H. Carpenter, 31, 36; Sir Robert Hadfield, 33; W. Rosenhain, 34; J. E. Stead, 35; C. A. Edwards, 37; Arthur Cooper, 38. *Correspondence*: J. H. Andrew, 38; F. C. A. H. Lantsberry, 40; A. McCance, 42; T. Swinden, 43; C. A. Edwards (reply), 44.

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EDWARDS, E. T., on grading of alloy steels. 1912, ii. 588.

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EDWARDS, G. E., on equipment of iron ore mines. 1912, i. 444, ii. 460; 1913, i. 520.

on Ilgner system of electric winding. 1912, ii. 512; 1914, ii. 310.

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- EDWARDS, G. E., on smelting low-grade ores. 1912, ii. 530.
- EDWARDS, G. M., on coal in Asia Minor. 1914, i. 600.
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- EDWARDS, J. C., on use of waste heat from coke-ovens. 1914, ii. 293.
- EDWARDS, J. D., on density determination in gases. 1917, ii. 469.
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- EDWARDS, J. W., on welfare of the iron and steel industry. 1916, ii. 420.
- EDWARDS, V. E., on power requirements for rolling-mills. 1914, i. 685.
- EGBERT, H. D., on gas cleaning. 1917, i. 341; 1918, i. 492.
- EGEBERG, BIRGER, elected member. 1921, i. 2.
- EGGERS, H., on iron ore calcination. 1911, i. 534.
- EGGERT, E. F., on oxy-acetylene cutting. 1914, ii. 360.
- EGLOFF, G., on analysis of petroleum. 1915, ii. 335; 1917, i. 423.
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- EGY, W. L., on coal-dust explosion tests. 1913, ii. 571.
- EHLERS, W. A., on fuels for heat treating. 1921, i. 438.
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- EHN, ERIK WILHELM, elected member. 1921, ii. 9.
- EHRENBERG, on shaft-sinking in collieries. 1912, i. 484.
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- EHRENWERTH, J. VON—
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- EHRHARDT, H., on manufacture of tubes. 1912, ii. 568.
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- EILENDER, W., on steel production by electrical processes. 1913, ii. 621.
- ELAM, (MISS) C. F., on crystal growth of metals. 1920, ii. 391.
- ELCOCK, EDWARD WILSON, elected associate. 1919, i. 6.
- ELDREDGE, A. G., on photo-micrography. 1919, ii. 528.
- ELGAR, J. B., on iron ore in Brazil. 1912, ii. 453.
- ELIN, G. S., on poisonous properties of ferro-silicon. 1914, ii. 385.
- ELLCOTT, C. R., on conservation of manganese. 1918, ii. 510.
- ELLIOT, T. G.—
Paper on "Volumetric estimation of sulphur in iron and steel." 1911, i. 412.—*Correspondence*: G. W. Gray, 420; T. G. Elliot (reply), 420.
on photo-micrographs of steel sections. 1920, i. 757.
elected member. 1912, i. 2.
- ELLIOTT, A. C., on economics of the petroleum industry. 1913, i. 559.

- ELLIOTT, A. F., on electric equipment of collieries. 1911, ii. 528.
- ELLIOTT, CHARLES EDWARD, elected member. 1917, ii. 2.
- ELLIOTT, FRANK, elected member. 1919, ii. 3.
- ELLIOTT, G. K., on electric furnace in foundry practice. 1920, i. 710 ; 1921, ii. 370.
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- ELLIOTT-COOPER, R., speech at Dinner by. 1913, i. 477.
- ELLIS, A. D., on present-day furnaces. 1913, i. 204.
- ELLIS, A. J., on history of the divining rod. 1917, ii. 345.
- ELLIS, C., on Bonecourt system of flameless combustion. 1912, ii. 477.
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- ELLIS, C. E., on manufacture of armour plates. 1911, ii. 604.
- ELLIS, C. H., on moulding machines. 1911, ii. 567.
- ELLIS, D., on iron bacteria. 1921, ii. 418.
- ELLIS, F. I., on development of hydraulic presses. 1911, ii. 574.
- ELLIS, J., on welding high-speed steel tips. 1917, ii. 429.
- ELLIS, JOHN DEVONSHIRE, elected member. 1921, ii. 9.
- ELLIS, O. W., on effect of cold work on properties of metals. 1920, i. 744.
- on macro-etching and macro-printing. 1919, i. 295.
- on non-metallic inclusions in steel. 1918, i. 301.
- elected member. 1916, i. 2.
- ELLIS, S. H., on corrosion of steel wharves in China. 1915, i. 624.
- ELLIS, W. H., on composition of natural gas. 1915, i. 527.
- ELLIS, SIR WILLIAM, on the Jurassic iron stones of the United Kingdom. 1918, i. 123.
- on manufacture and treatment of steel for guns. 1912, i. 331.
- on ship plates and boiler plates. 1912, ii. 156.
- on welding-up of blowholes in steel. 1911, i. 76 ; 1921, i. 50.
- elected Vice-President. 1915, i. 14.
- ELLISON, EDMUND GEORGE, elected member. 1919, i. 3.
- ELLS, R. W., on petroleum in Trinidad and Barbados. 1911, ii. 516.
- ELLSWORTH, W. E., on Calgary-Alberta oil-fields. 1914, ii. 298.
- ELMORE, G. H., on coal washing. 1918, i. 488.
- ELOY, F., on compression shocks. 1921, ii. 398.
- ELSE, FRANK, elected member. 1918, i. 3.
- ELSE, LEONARD HAROLD, elected member. 1918, i. 3.
- ELSE, STANLEY CYRIL, elected member. 1914, i. 2.
- ELSTON, C. M., on estimation of sulphur in gas. 1916, ii. 469.
- ELWELL, C. F., on arc and induction furnaces. 1911, ii. 593.
- ELWITZ, E., on shaft-sinking. 1912, ii. 508.
- on artificial pumice from blast-furnace slag. 1914, i. 652.
- on utilisation of slag. 1913, ii. 590.
- ELWOOD, ARTHUR WILLIAM, elected member. 1919, ii. 3.
- ELWOOD, W. F., on influence of temperature on valuation of fuel. 1913, ii. 535.
- EMBLETON, R., on high-speed gas-engines. 1915, i. 530.
- EMERY, A. H., JUN., on new form of testing machine, for tension or compression. 1913, i. 655, 656.
- EMERY, W., on corrosive action of flue-dust on firebricks. 1919, i. 632.

- EMERY, W., on influence of load on refractoriness of firebricks. 1918, ii. 443.
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- EMMEL, C., on use of scrap iron briquettes. 1911, ii. 562.
- EMMEL, L., on moulding. 1914, i. 664.
- EMMONS, J. V., on heat treatment of steel. 1912, i. 549.
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- EMMONS, W. H., on exploration of metalliferous deposits. 1917, ii. 339.
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- EMPERGER, F. VON, on reinforcements of concrete with cast iron. 1912, i. 566 ;
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- ENDELL, K., on behaviour of refractory bricks at high temperatures. 1921,
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on disintegration of blast-furnace slag. 1920, i. 708.
on manufacture of firebricks. 1912, i. 455.
on silica bricks. 1914, i. 589.
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on study of microstructure by means of polarised light. 1914, i. 716, 717.
- ENGELBACH, H., on iron ore in the Lake Superior district. 1913, ii. 505.
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- ENGELHARDT, V., on electric furnaces of special types. 1911, i. 624.
- ENGLE, W. D., on determination of cobalt. 1917, i. 423.
- ENGLER, C., on origin of coal. 1912, i. 461.
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- ENGLISH, W. A., on coal in the United States. 1915, ii. 234.
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- ENNIS, L.—
“ Report on present status of fuel economy in the German iron and steel
industry of the occupied territory.” See JOHNS, COSMO.
elected member. 1920, i. 3.
- ENNIS, W. D., on gas-producer practice. 1912, ii. 504.
- ENOS, G. M., on determination of tungsten. 1921, i. 472.
- ENRIGHT, J. E., on producer-gas from coke. 1917, ii. 379.
- ENSAW, H., on case-hardening. 1918, ii. 481.
- ENSMINGER, G. R., on surface changes of steel. 1921, i. 438.
- ENZENAUER, J., on silica bricks for coke-oven construction. 1920, ii. 317.
- ENZIAN, C., on hydraulic mine-filling in Pennsylvania. 1914, ii. 309.
- EPFS, F. A., on influence of high temperature on properties of wrought iron.
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- EPSTEIN, S., on deep etching of steel. 1921, i. 465.
- EPWORTH, F. W., on use of gaseous fuel in furnaces. 1919, ii. 470.
- ERBREICH, F., on contraction of cast iron. 1914, i. 702.
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- ERDMAN, A. W., on limits and tolerances in the manufacture of munitions. 1917, ii. 428.
- ERDMANN, E., on constituents of lignite. 1921, ii. 349.
- ERHARD, G., on preparation of tungsten. 1912, ii. 616.
- ERICHSEN, A. M., on metal drawing and stamping. 1914, ii. 348.
- ERIKSSON, H., on methods of working iron ore. 1912, ii. 461.
- ERLICH, J., on analysis of tungsten ores. 1920, ii. 398.
- ERVIN, J. F., on cupola practice. 1916, i. 338.
- ESCARD, J., on electric furnace practice. 1919, i. 666.
on electric smelting of iron ore. 1918, ii. 462.
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- ESCH, F. W., on iron as substitute for copper in electric conductors. 1915, ii. 315.
- ESCHENBRUCH, on coal-washing. 1912, ii. 518.
- ESCHHOLZ, O. H., on arc-welding. 1919, i. 677; 1921, i. 443.
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- ESSICH, O., on carbon dioxide in the gas-producer. 1921, i. 395.
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- ESTAPE, R. D', on storage of coal. 1914, ii. 314.
- ESTEP, H. C., on American foundries. 1912, i. 524; 1916, i. 343.
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- ESTEP, T. G., on measurement of blast volume from turbo-blowers. 1918, i. 490.
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- ESTES, C., on bibliography of alloys. 1917, i. 407.
- ESTLER, H. C., elected member. 1914, i. 2.
- ETCHELLS, H., on electric furnaces. 1919, i. 665.
- EVANS, B. S., on estimation of chromium in steel. 1921, ii. 420.
- EVANS, D., on alloy steel castings. 1917, i. 355.
- EVANS, DAVID GLYNN, elected associate. 1917, ii. 5.

- EVANS, DAVID GLYNN, transferred to membership. 1920, i. 7.
- EVANS, E. C., on gases in mines. 1912, ii. 514.
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- EVANS, E. V., on analysis of coal-gas. 1915, i. 636.
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- EVANS, G. W., on coal in Alaska. 1921, i. 384.
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- EVANS, H. A., on oil as fuel in forges. 1911, i. 607.
- EVANS, JOHN, obituary notice of. 1914, i. 553.
- EVANS, J. L., on development of gas-engines. 1920, i. 703.
- EVANS, J. W., on manufacture of ferro-alloys. 1919, i. 668.
on manufacture of tool steel from titaniferous magnetite. 1913, i. 600.
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- EVANS, OWEN G., elected member. 1916, i. 2.
- EVANS, S., on corrosion. 1915, i. 625.
- EVANS, THOMAS MEREDITH, elected member. 1921, ii. 9.
- EVANS, WILLIAM, (Vice-President), obituary notice of. 1915, i. 454.
- EVERSHEED, S., on permanent magnets. 1921, i. 462.
- EVESON, G. J., obituary notice of. 1915, i. 458.
- EWEN, D., on disintegration of metals by heating. 1914, i. 741.
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- FABRE, L., on Bayer-Pintsch apparatus for gas analysis. 1913, i. 697.
- FABRY, S. DE, on variation of properties and structure of tool steels. 1912, ii. 382.
- FAGERBERG, G., on transport of Cellivare iron ore. 1921, ii. 339.
- FAHRENWALD, A. W., on laboratory furnaces. 1917, ii. 466.
- FAHRENWALD, F. A., on tungsten-molybdenum system. 1916, ii. 460.
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- FAHY, F. P., on magnetic analysis. 1920, i. 750.
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- FAIRBANKS, F. B., on drop forgings. 1921, ii. 380.
- FAIRCHILD, C. O., on pyrometry. 1916, ii. 393. 1919, ii. 468. 1920, i. 686, 689; 1921, ii. 384.
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- FAIRHURST, GEORGE HENRY, elected member. 1917, i. 2.
- FAIRLIE, D. M., on synthesis of hydrocarbons. 1912, ii. 628.
- FALCK, G. E., on composition and utilisation of Livornese magnesite. 1916, i. 302.
Chairman Italian Reception Committee. 1911, ii. 2, 3, 5, 7.

- FALCK, G. E., elected Honorary Vice-President. 1912, i. 15.
- FALCKE, V., on blast-furnace reactions. 1915, i. 545; 1921, ii. 363.
on iron-carbon system. 1913, i. 682.
- FALK, A., on displacement of material during rolling. 1912, i. 569.
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- FALK, GORDON SANDS, elected member. 1912, i. 2.
- FALKENBERG, E. O., on molybdenum in Norway. 1921, ii. 336.
- FALKENBURG, M. J., on corrosion of iron and steel. 1911, ii. 650.
- FANNING, P. R., on iron ore in the Philippines. 1912, i. 433.
- FARMER, F. M., on testing machines. 1920, i. 740.
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- FARNHAM, R. V., on gas-producer for bituminous coal. 1916, i. 322.
- FARQUHAR, R. B., JUN., on pouring of steel castings. 1921, i. 413.
- FARR, A. V., on calorising of metals. 1921, i. 449, ii. 391, 416.
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- FARRELL, JAMES A., speech at Dinner by. 1914, i. 545.
- FARRINGTON, O. C., on meteorites. 1911, ii. 484; 1912, i. 443; 1915, i. 490;
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- FARUP, P., on electric smelting of iron ore. 1913, i. 594; 1915, i. 554.
- FASOLA, J. J., on the driving of rolling-mills. 1913, i. 639.
- FAULKNER, CHARLES LOUIS, elected member. 1913, ii. 4.
- FAULKNER, V. C., on steel foundry practice. 1917, i. 355
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- FAUST, O., on tensile tests of material. 1911, i. 647.
- FAWCETT, JAMES WORTLEY, elected member. 1916, i. 3.
- FAWSITT, C. E., on corrosion of metals. 1912, i. 591; 1914, i. 734; 1919,
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- FAY, A. H., on accidents in mines in United States. 1913, ii. 724.
on analysis of American coals. 1915, i. 506; 1916, i. 311.
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- FAY, H., on case-hardening. 1921, i. 435.
on causes of failure in metals. 1911, ii. 614.
on comparative heat-treatment of acid and basic open-hearth steel. 1911,
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on heat-treatment of nickel steels. 1911, ii. 601.
- FAYOL, H., on storage and spontaneous combustion of coal. 1912, ii. 517.
- FEA, L., on mechanical tests of special steels for naval ships. 1912, ii. 382.
- FEARNEHOUGH, WILLIAM, elected member. 1912, i. 3.
- FEARNSIDES, W. G., on application of petrographic methods to the study of
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on refractory sands in England. 1917, i. 300.

FEARNSIDES, W. G., on Sorby's life and work. 1914, i. 651.

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FELD, W., on by-product recovery. 1912, ii. 491.

on cleaning blast-furnace gases. 1912, ii. 524.

FELDMANN, K., on transport and storage of natural gas. 1912, i. 478.

FELDTMANN, F. R., on magnesite in Western Australia. 1917, i. 296; 1920, i. 677, ii. 315.

FELL, (MISS) MURIEL—

Paper on "Temper-brittleness of nickel-chrome steel." *See* GREAVES, R. H.

FELL, ROBERT CECIL DIXON, elected member. 1916, i. 3.

FELLOWS, FELIX, elected member. 1920, ii. 3.

FELT, C. F. W., on rail failures. 1916, i. 380, ii. 449.

FENDICK, ALBERT CHITTY, elected member. 1920, ii. 3.

FENNELL, W., on gas-engines. 1913, ii. 562.

FENWICK, A., on deterioration of turbine blading. 1918, i. 543.

FEREDAY, WILLIAM VALENTINE, elected member. 1919, ii. 3.

FERGUSON, D., on coal in Scotland. 1916, ii. 397.

FERGUSON, J. B., on melting points of cristobalite and tridymite. 1918, ii. 443.

on occurrence of molybdenum in rocks. 1914, ii. 271.

FERGUSON, J. C. H., on manufacture of rolled steel shells for rolls. 1915, i. 590.

FERGUSON, J. M.—

Paper on "A method of preparing sections of fractures of steel for microscopic examination." *See* CAMPION, A.

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FERMOR, L. L.—

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FERNALD, H. B., on mine accounting. 1913, ii. 517.

FERNALD, R. H., on gas-producers. 1911, ii. 522; 1912, i. 482; 1913, ii. 560; 1917, ii. 378.

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FERRANTI, S. Z. DE, on conservation of coal in Great Britain. 1911, ii. 671.

FERRIER, W. F., on mineral resources of British Columbia. 1921, i. 371.

FERRIS, D. S., on the Evans sand-blast cleaning machine. 1914, i. 666.

FERRY, E. S., on pyrometry. 1915, ii. 231.

FÉRY, C., on modification of Berthelot-Mahler calorimetric bomb. 1912, i. 458.

FESCHTCHENKO-TCHOPOVSKY, S. A., on case-hardening of iron. 1917, i. 380; 1918, i. 524.

FETTKE, C. R., on heat value of fuel. 1911, i. 539.

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on iron ore in Porto Rica. 1918, ii. 431.

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FETTWEIS, H., on coke-oven gases. 1911, i. 552.

FETTWEISS, F., on analysis of high-speed steel. 1914, i. 745

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on microstructure of special steel alloys. 1913, i. 679.

FICHTNER, R., on a cupola explosion. 1913, ii. 596.

on tapping of cupolas. 1914, ii. 326.

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FICK, K., on the iron-copper system. 1914, i. 729.

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FICKENSCHER, on iron ore in Germany. 1914, i. 570.

FICUS, on Honigmann method of shaft-sinking. 1911, ii. 485.

FIEBER, R., on estimation of tungsten in ferro-tungsten. 1912, ii. 620.

FIELD, A. B., on testing of tool steels. 1915, ii. 307.

FIELD, H., on semi-steel. 1921, i. 413.

elected member. 1921, ii. 9.

FIELD, H. E., on moulding sand. 1912, ii. 546.

FIELD, R. A., on iron industry of Australia. 1918, i. 558.

FIELDEN, F., on gas-producers. 1911, i. 561; 1912, i. 480; 1914, ii. 304.

FIELDNER, A. C., on analysis of coal. 1912, ii. 627; 1913, i. 695; 1914, ii. 396; 1915, i. 635.

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on fusibility of coal ash. 1915, ii. 332; 1919, ii. 470; 1920, ii. 323.

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- FIELDNER, A. C., on softening tests of coal-ash. 1916, i. 307, 308.
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- FIGUEROLA, A. P., on coal in Peru. 1920, ii. 326.
- FILLUNGER, A., on underground fires. 1914, i. 630.
- FINDLEY, A. E., on corrosion of coke-oven walls. 1921, i. 388.
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- FINDLEY, ALWIN IRWIN, elected member. 1920, i. 3.
- FINK, C. G., on manufacture of ferro-alloys. 1921, i. 406.
- FINKL, W., on simplified rapid method for carbon determination. 1919, i. 700.
- FINLAY, JACK, elected member. 1920, ii. 3.
- FINLAY, J. R., on economics of ore mining. 1912, i. 446.
 on geology of coal. 1919, ii. 472.
 on mine valuation. 1912, ii. 463 ; 1913, i. 522, ii. 518.
- FINLAYSON, FINLAY, obituary notice of. 1912, ii. 432.
- FINN, A. N., on metallic coatings for iron and steel. 1919, ii. 535.
- FINN, C. P., on oil-shale in Yorkshire. 1912, i. 473.
- FINZE, on history of coke-manufacture. 1912, ii. 493.
- FIRTH, B., on crucible steel works. 1911, i. 617.
- FIRTH, EDITH M., on British fireclays. 1921, ii. 340.
- FIRTH, FREDERICK WILLIAM, elected member. 1918, i. 3.
- FIRTH, J. N., on utilisation of small coal. 1917, ii. 362.
- FIRTH, WYBERT, elected member. 1918, i. 3.
- FISCHER, A., on estimation of molybdenum. 1912, ii. 624.
- FISCHER, C. G., on new form of optical pyrometer. 1914, i. 592.
- FISCHER, F., on low-temperature carbonisation of coal. 1917, ii. 370 ; 1920, ii. 328.
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- FISCHER, F. L., on mine surveying. 1912, ii. 459.
- FISCHER, M. F., on magnetic testing of ball-bearing races. 1920, i. 751.
- FISCHER, S., on concentration of ore. 1912, ii. 464.
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- FISCHER, V. M., on preparation of sulphides of manganese. 1915, ii. 332.
- FISCHMANN, H., on standard sections for structural steel. 1917, ii. 419.
- FISH, E. H., on preservative coatings for metals. 1915, ii. 327.
- FISHBACK, M., on Utahnite explosive. 1912, ii. 459.
- FISHER, F. P., on measurement of natural gas. 1916, ii. 408.
- FISHER, G. P., on converters in foundry practice. 1920, i. 711.
- FISHER, H. J., on coal-cutting machinery. 1911, ii. 528.
- FISHER, J. P., on transport of natural gas. 1915, ii. 248.
- FISHER, ROBERT BOWDEN, elected member. 1921, i. 2.
- FISHER, W. L., on coal in Alaska. 1912, i. 468.
 on mining laws in Australia and New Zealand. 1912, ii. 517.
- FISK, G. L., on duplex process. 1920, i. 717.
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- FITCH, E. O., JUN., on influence of vanadium on pig iron. 1914, ii. 363 ; 1915, i. 595, ii. 269.
- FITCH, W. H., on pulverised coal. 1920, i. 690.
- FITZGERALD, C., JUN., on power requirements in rolling-mills. 1914, i. 685.

- FITZGERALD, F. A. J., on economies in electric furnace energy. 1914, ii. 340
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- FLACK, F. V., on solubility of phosphoric oxide in basic slag. 1911, i. 688.
- FLADE, F., on passivity of iron. 1912, ii. 614; 1915, i. 628.
- FLAGG, A. L., on application of microscopy to mining iron ore. 1913, ii. 514.
- FLAGG, S. B., on carbon dioxide recorders. 1916, ii. 394.
- FLANAGAN, W. N., on steelworks power plants. 1921, i. 433.
- FLANDERS, F. F., on bomb calorimeter. 1917, ii. 361.
- FLANNERY, J. M., on uranium steel. 1917, ii. 456.
- FLECK, on coal in Austria. 1913, i. 537.
- FLECK, H., on molybdenum and its uses. 1917, i. 286.
- FLEGEL, K., on iron ore in Great Britain. 1912, i. 431.
 on measurement of temperatures at great depths. 1914, i. 628.
- FLEISSNER, H., on composition of blast-furnace slag. 1911, i. 590; 1912, i. 510, ii. 536.
 on diamonds in blast-furnaces. 1911, i. 585.
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- FLEMING, A. P. M., on radiology applied to testing. 1921, i. 458.
- FLEMING, J. A., on electric furnaces. 1911, ii. 589.
 on pyrometry. 1911, ii. 503.
- FLEMING, R., on strength of steel structures. 1913, ii. 664.
- FLEMING, W. R., on corrosion of iron and steel. 1912, ii. 610; 1913, i. 685.
 on determination of carbon in steel. 1913, i. 690.
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- FLETCHER, B. J., on artistic treatment of cast iron. 1913, ii. 606.
- FLETCHER, G., on peat as a source of power. 1916, i. 311.
- FLETCHER, J. E.—
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on manufacture, properties, and structure of cast iron. 1914, ii. 363.

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on slag in the open-hearth process. 1920, i. 313.

on steel ingot defects. 1917, i. 90.

on steel metallurgy. 1919, i. 195.

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FLETCHER, R. J., on Fescol process for repair of machine parts. 1921, ii. 395.

FLETCHER, R. L., on repair of furnace linings. 1919, ii. 466.

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FLOOD, GEORGE A., elected member. 1914, i. 2.

FLORY, B. P., on electric welding. 1912, ii. 577.

FOERSTER, F., on low-temperature distillation of coal. 1921, i. 390.

FOHL, W. E., on economics of coal-mining. 1915, ii. 255.

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FOLEY, F. B., on crystallisation of steel runner. 1919, ii. 531.

on drill steel tests. 1921, ii. 389.

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on photo-micrography. 1919, ii. 528.

FOLLET, L., on manufacture of tinplates. 1911, ii. 606.

FOOTE, F. W., on estimation of tungsten. 1919, i. 701.

on mineral resources of Portugal. 1918, ii. 435.

FOOTE, P. D., on calibration of optical thermometers. 1913, ii. 533.

- FOOTE, P. D., on high temperature control. 1920, i. 686.
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 on standard scale of temperature. 1920, i. 688.
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- FOOTE, W. M., on meteoric iron. 1913, i. 520 ; 1914, ii. 273 ; 1915, i. 490.
- FOOTE MINERAL Co., on electric furnace refractories. 1921, i. 378.
- FORBES, W. A., on cleaning blast-furnace gas. 1914, i. 641.
- FORBES-LESLIE, W., on the oil-shales of Norfolk. 1917, i. 320.
- FORBES-SCOTT, GEEWYN, elected associate. 1921, i. 6.
- FORCE, H. J., on failure of chilled wheels. 1921, ii. 407.
- FORD, E. L., on use of washed metal in steel making. 1916, i. 330 ; 1918, i. 513.
- FORD, GRAHAM, elected member. 1914, i. 2.
- FORD, J., on coal in Nottinghamshire. 1920, i. 692.
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- FORD, L. D., on coal-washing. 1914, i. 635.
 on a Westphalian by-product coking plant. 1914, i. 605.
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- FORD, L. R., on the use of fuel oil. 1917, i. 326.
- FORNANDER, E., on electric smelting of iron ore. 1913, ii. 586.
 on metallurgy of open-hearth process. 1916, i. 345.
- FORREST, B. J., on utilisation of peat. 1919, ii. 481.
- FORRESTER, J. B., on underground fires. 1915, ii. 254.
- FORSBERG, FREDRIK, elected member. 1914, i. 2.
- FORSBERG, G. A., on combined electric and Lancashire hearths. 1915, i. 557.
- FORSBERG, U., on manufacture of steel for ball bearings. 1914, ii. 371.
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- FORSYTH, A., on gas-fired crucible furnaces. 1918, i. 510.
- FORSTER, J., on cupola practice. 1911, i. 592.
- FORSTER, J. B., on determination of cobalt and nickel in cobalt steel. 1918, i. 446.
 elected member. 1918, ii. 2.
- FORSTMANN, on rescue appliances in mines. 1913, ii. 572 ; 1914, i. 633.
- FORSTNER, W., on petroleum in the United States. 1911, i. 555.
- FORSYTH, D. F., on iron ore in South Africa. 1915, ii. 217.
- FORSYTHE, W. E., on pyrometry. 1920, i. 689, ii. 320.
- FORWARD, A. J., on commercial uses for peat. 1915, i. 513.
- FOSTER, C. E., on pyrometry. 1911, i. 538, ii. 503 ; 1912, i. 459.
- FOSTER, F., on fuel economy. 1919, ii. 111.
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 on gas-engines. 1911, i. 563.
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- FOSTER, J. E., on manufacture of firebricks. 1917, ii. 350.
- FOSTER, L., on application of electricity to coal-mining. 1915, i. 533.
 on breakdowns in colliery electric installations. 1915, i. 533.
- FOSTER, O. R., on atomic structure. 1921, i. 466.
- FOSTER, W., on asphaltic minerals. 1913, ii. 556.
- FOSTER, W. J., on blast-furnace bears. 1918, i. 214.
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- FOSTER, W. J., on fuel economy in blast-furnace. 1920, ii. 107.
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- FOUCAE, J. L., on estimation of sulphur. 1912, i. 609.
- FOULD, MAURICE, elected member. 1914, ii. xix.
- FOULD-DUPONT, A., obituary notice of. 1914, i. 553.
- FOURGEOT, on hardening furnaces. 1911, i. 631.
- FOURMARIER, P., on the Sambre and Meuse coalfield. 1913, ii. 538.
- FOWLER, H., on standard treatment of chisels. 1916, i. 361.
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- FOWLER, SIR H., on fractures of boiler tubes. 1921, i. 459.
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- FRAENKEL, on microstructure of meteoric nickel iron. 1911, i. 663.
- FRANCIS, A. V., on bluing of steel products. 1914, i. 701.
- FRANCIS, C. K., on sulphur in petroleum oils. 1917, ii. 375.
 on technology of petroleum. 1920, ii. 337.
- FRANCIS, J. R., on corrosion of boilers. 1912, ii. 613.
- FRANCKE, W. J., on testing apparatus. 1921, i. 452.
- FRANCLIEU, H. DE, on handling Algerian ores. 1914, i. 582.
- FRANCO, ALFRED, elected member. 1912, i. 3.
- FRANK, F., on peat. 1911, i. 548.
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- FRANKE, G., briquetting iron ore. 1911, i. 533.
- FRANKLIN, F. H., on estimation of sulphur. 1914, i. 743.
- FRANKLIN, J. S., on shaft-sinking in collieries. 1912, i. 484.
- FRANKS, A. J., on shale-oil in Canada. 1921, ii. 356.
- FRANTZEN, on hydraulic packing in coal-mines. 1915, i. 534.
- FRANZ, F., on coal in Austria. 1912, i. 463.
- FRANZ, W. C., elected member. 1921, i. 2.
- FRASER, A., on stresses in castings. 1920, i. 739.
- FRASER, ANDREW BROWN, elected member. 1912, ii. 5.
- FRASER, GORDON HENRY, elected member. 1920, ii. 3.
- FRASER, GRAHAM, obituary notice of. 1916, i. 271.

- FRASER, JOSEPH DIX, elected member. 1912, ii. 5.
- FRASER, L., on economics of ore mining. 1912, i. 446.
- FRASER, T., on sulphur in coal. 1920, i. 691; 1921, i. 390.
- FRAY, W. P., on fuel briquetting. 1917, ii. 386.
- FRAZER, J. C. W., on analysis of furnace gases. 1912, i. 612.
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- FRECH, F., on coal reserves of Germany. 1912, i. 624.
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- FRÉCHETTE, H., on iron ore in Canada. 1912, i. 436.
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- FREELAND, W. E., on foundry economics. 1917, i. 360.
- FREEMAN, O. W., on petroleum in United States. 1920, i. 700.
- FREEMAN, P. J., on slag cement. 1919, i. 653.
- FREESTON, THOMAS ADAMS, elected member. 1921, ii. 9.
- FREIMUT, G., on recovery of iron from foundry waste. 1912, i. 514.
- FREISE, F., on coal in Brazil. 1911, ii. 511; 1912, ii. 487.
- FRÉMINVILLE, C. DE, on brittleness and "bursting." 1915, i. 599.
- FREMONT, C., on blue brittleness of welds. 1921, i. 445.
on buckling of metal tubes subjected to compression. 1913, ii. 664.
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- FRENCH, A. T., on proximate analysis of ores in slags. 1912, ii. 622.
- FRENCH, E. H., on hardwood distillation industry of United States. 1915, i. 512.
- FRENCH, EDMUND LEAVENWORTH, elected member. 1914, i. 2.
- FRENCH, H. J., on ageing of steel. 1921, ii. 408.
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- FRENCH, W. E., on electric equipment of collieries. 1912, ii. 509.
- FRENTZEL, A., on geology of petroleum. 1913, i. 551.
- FREIRICH, F. W., on reinforced concrete for storage tanks. 1919, i. 641.
- FREY, C. P., on pyrometry. 1919, ii. 467; 1920, ii. 320.
- FREY, J. P., on early manufacture of cast iron stove plates. 1914, ii. 324.

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FREYN, H. J., on blowing-engines. 1913, i. 584.

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FRIEDENSTEIN, JOSEPH, elected member. 1914, ii. xix.

FRIEDLAENDER, E., on electric driving of rolling-mills. 1914, i. 684.

FRIEDMANN, on corrosion of iron and steel. 1911, ii. 649.

FRIEDRICH, H., on cutting-tests with tool steels. 1914, i. 707.

FRIEDRICH, K., on heat-treatment of steel. 1912, i. 549.

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Paper on "The corrosion and preservation of iron." **C.S.M.**, 1911, iii. 1; is an acid essential to corrosion, 1; various factors influencing the rate of corrosion of relatively pure iron at ordinary temperatures, 3; the action of acids, alkalis and salts upon iron, 25; the protection of iron and steel by cement, 38; the protection of iron by means of paint, 46; conclusion, 64; summary, 64.

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Paper on "The preservation of iron." **C.S.M.**, 1913, v. 1.

Paper on "Protection of iron with paint against atmospheric corrosion." **C.S.M.**, 1918, ix. 77.

Paper on "Influence of carbon and manganese upon the corrosion of iron and steel." See HADFIELD, Sir ROBERT.

FRIEND, J. NEWTON, on action of steam on iron. 1911, ii. 651.

on corrosion of iron and steel. 1911, ii. 649, 650; 1913, ii. 687; 1914, i. 734; 1915, i. 624; 1916, i. 391, 393; 1921, ii. 417.

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on passivity of iron. 1912, i. 596.

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FRIEND, J. N., and P. C. BARNET—

Paper on "The corrosion of iron in aqueous solutions of inorganic salts." 1915, i. 336; introduction, 336; Friend and Brown's experiments of 1911, 338; results of present experiments, 341.

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Paper on "The relative corrodibilities of grey cast iron and steel." 1915, i. 353; particulars of tests, 353; results obtained, 354; consideration of the results, 356; conclusion, 357.—*Correspondence*: T. Turner, 364.—*Authors (reply)*: 364.

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FRILLEY, R., on silicon alloys. 1911, ii. 628.

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FROELICH, W., on influence of gases on nickel steel. 1914, i. 730.

- FROOD, JOHN, elected member. 1917, ii. 2.
- FROST, ALBERT, elected member. 1918, i. 3.
- FROST, E. J., on standardisation of forgings. 1919, ii. 507.
- FRY, A., on etching reagents. 1920, ii. 391.
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- FRY, (MISS) HILDA E., elected member. 1918, ii. 2.
- FRY, LAWFORD H.—
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- FRY, SIR THEODORE, BART., obituary notice of. 1912, i. 410.
- FUCHOS, O., on influence of temperature and mechanical work on the forging
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- FUCHS, F. C., on identification of molybdenite. 1918, ii. 433.
- FUCHSEL, M., on micrography of broken axle. 1914, i. 716.
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- FULLAGER, H. A., on a new type of gas-engine. 1914, ii. 306.
- FULLER, B. D., on influence of gating on castings. 1917, i. 352.
- FULLER, J. T., on explosives and blasting. 1912, ii. 459.
- FULLER, J. W., on use of pulverised coal as fuel. 1917, i. 306.
- FULLER, S. J., on transport of ferro-silicon. 1913, ii. 696.
- FULLER, T. S., on corrosion. 1921, i. 470.
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- FULLERTON, A., obituary notice of. 1911, i. 497.
- FULTON, A. M., on influence of gating on castings. 1917, i. 352.
- FULTON, R. V., on estimation of iron. 1921, i. 472.
- FULWEILER, W. H., on refractory problems. 1920, i. 678.
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- FURNESS, BENJAMIN HAYWOOD, elected member. 1917, ii. 2.
- FURST, J. K., on the Duplex process. 1915, i. 570; 1917, ii. 405; 1918, i. 512.
- FURTH, A., on analysis of gas. 1912, ii. 629.
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- FURTH, H., on use of scrap-iron briquettes. 1912, ii. 541.

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- GAAB, F. C. W., on utilisation of waste heat of furnaces. 1912, ii. 525.
- GABRIEL, G., on steel for valves. 1921, i. 459.
- GAD, E., on oil analysis. 1911, ii. 668.
- GADD, C. J., on powdered coal as fuel in open-hearth furnace. 1916, ii. 429.
- GADDI, L., on coal crisis in Italy. 1915, ii. 343.
- GAGARIN, PRINCE A., on autographic stress-strain record in impact tests. 1912,
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- GAINES, R. H., on composition and tests of monel metal. 1912, ii. 608.
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- GALANE, C., on utilisation of peat. 1917, ii. 366.
- GALE, C. H., on influence of titanium on cast iron. 1913, i. 659.
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- GALE, H. S., on magnesite deposits of United States. 1913, ii. 530 ; 1914, ii. 282 ; 1916, ii. 386.
- GALIBOURG, J., on case-hardening practice. 1920, ii. 371.
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- GALL, H., on progress in electro-metallurgy. 1914, ii. 384.
- GALLANDER, O., on determination of depth of segregation in metals. 1912, ii. 382.
- GALLO, G., on electrolytic corrosion of iron and steel. 1913, ii. 690.
- GALLON, M. E., on cupola construction. 1913, ii. 595.
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- GALLOWAY, C. F. J., on coal in British Columbia. 1912, ii. 483.
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- GALLOWAY, W., on coal-dust experiments. 1912, i. 488.
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- GALLOWAY, WALTER, elected member. 1918, ii. 2.
- GALMARD, RAYMOND, elected member. 1921, ii. 9.
- GALOPIN, ALEXANDRE, elected member. 1921, ii. 9.
- GALVIN, J. W., on electric furnaces in foundries. 1921, i. 413.
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- GALY-ACHÉ, P., on strain phenomena. 1913, ii. 661.
- GANDER, J. S., on combustion of oil fuel in marine boilers. 1914, i. 614.
- GANNET, R. W., on enrichment of tungsten ores. 1919, ii. 462.
- GANTT, H. L., on production and costs of foundries. 1916, i. 343.
- GANZ, A. F., on corrosion of iron and steel. 1912, ii. 611.
- GARAND, L., on rolls for planished bars. 1919, i. 671.
- GARCIA, J. A., on coal in Oklahoma. 1912, ii. 486.
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- GARCON, J., on zirconium steel. 1919, i. 696.
- GARD, W. H., on welding. 1919, ii. 514.
- GARDNER, H. A., on protective coatings for iron. 1913, ii. 692 ; 1915, i. 628 ; 1921, i. 469.
- GARDNER, J. H., on methods of working oil wells. 1915, ii. 246.
- GARDOM, JOHN WILLIAM, elected member. 1919, i. 3.
- GARFIAS, V. R., on petroleum in California. 1914, i. 611 ; 1915, i. 522.
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- GARFORTH, W. E., on coal-dust experiments. 1911, i. 572, ii. 533 ; 1913, i. 574, 629.
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- GARLAND, C. M., on efficient combustion of gases. 1913, ii. 534.
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on low-temperature distillation of coal. 1920, i. 698.

- GARLEPP, B., on coal handling. 1911, ii. 538.
- GARNETT, CECIL STEVENSON, elected associate. 1917, i. 5.
- GARN, H., on wear of rails. 1914, ii. 374.
- GARRATT, F., on determination of chromium in steel. 1913, ii. 700.
on determination of vanadium in steel. 1912, ii. 621.
elected member. 1911, i. 2.
- GARRETT, F. C., on examination of coal by X-rays. 1912, ii. 479.
- GARRETT, G. B., on gas cleaning. 1921, i. 100.
elected member. 1920, i. 3.
- GARRY, A., on cleaning castings. 1911, i. 604.
on moulding-sand. 1912, ii. 546.
- GARTNER, P., on colour etching of steels. 1911, ii. 634.
on heat-treatment of steel. 1911, i. 635.
on metallographical appliances. 1911, i. 661.
- GARVIN, M.—
Paper on "The experimental investigation of the influence of the rate of cooling on the hardening of carbon steels." *See* PORTEVIN, A. M.
on cooling curves of quenched metals. 1918, i. 554.
on influence of rate of cooling on hardening. 1920, ii. 372.
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- GARY, M., on testing of firebricks. 1915, i. 498.
on tests of iron-Portland cement. 1912, ii. 383; 1915, ii. 267; 1921, i. 409.
- GASCHE, F. G., on gas-engines. 1914, ii. 306.
- GASSMAN, H. M., on lighting of rolling-mills. 1912, i. 533.
- GATES, A. O., on crushing machinery. 1913, ii. 518.
- GATES, G. M., on underground haulage. 1911, i. 568.
- GATES, H. D., on sand-blasting castings. 1914, ii. 332; 1919, ii. 493; 1920, i. 713.
- GATEWOOD, R. D., on plate reheating furnace. 1912, ii. 568.
- GATHMANN, E.—
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- GAUGER, A. W., on inflammability of blast-furnace gas and air. 1917, ii. 382.
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- GAUNT, J., on foundry practice. 1913, i. 607.
on production of aluminium castings. 1917, i. 358.
- GAUTIER, A., on bauxite. 1911, ii. 499.
on estimation of titanium. 1912, i. 611.
- GAVIN, M. J., on economic importance of oil-shales. 1921, i. 393.
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- GAVIN, M. J., on oil-shale in the United States. 1920, ii. 335.
- GAWALOWSKI, A., on apparatus for gas analysis. 1911, ii. 669.
- GAWTHROS, R. M., on mineral resources of West Virginia. 1916, i. 311.
- GAYLER, (MISS) MARIE L. V., elected member. 1918, ii. 2.
- GAYLEY, J., on dry air blast. 1911, i. 583; 1912, ii. 523; 1913, ii. 580.
on agglomeration of fine ores. 1911, ii. 491.
on Dwight-Lloyd sintering process. 1912, ii. 465.
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- GAZE, M., on electric driving of blowing-engines. 1920, ii. 361.
- GEBERT, N. J., on influence of elements on steel. 1919, ii. 517.
on magnetic properties of steel, 1920, i. 749.
- GEBERT, RUSSELL C., elected member. 1920, i. 3.
- GEBHARDT, on shaft-sinking. 1911, ii. 526.
- GEDDES, SIR AUCKLAND, speech at Dinner by. 1919, i. 601.
- GEE, W. J., on concentration of ore. 1912, ii. 463.
- GEE, W. W. H., on prevention of corrosion of metals. 1913, i. 686.
- GEER, G. DE, on electric smelting of pig iron. 1921, i. 405.
- GEER, BARON LOUIS DE, elected member. 1911, i. 3.
- GEHRIG, A. G., on heat-treatment of nickel steel. 1919, ii. 508.
- GEIGER, C., on preparation of moulding sand. 1913, i. 613.
on use of carbon bricks in blast-furnaces. 1913, i. 580.
- GEIJER, G., on economy of the blast-furnace. 1915, i. 545.
- GELJER, P., on iron ore in Lapland. 1913, ii. 498; 1914, i. 571.
on iron ore in Sweden. 1911, i. 517.
- GEISBEEK, S., on value of Seger cones as pyrometers. 1913, i. 533.
- GEILENKIRCHEN, on steel foundry practice. 1913, ii. 600.
- GEISMER, H. S., on concentration of brown iron ores. 1911, ii. 488.
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- GEISSEL, A., on cast iron. 1921, i. 450.
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- GELLERT, N. H., on cleaning of blast-furnace gas. 1920, i. 707; 1921, ii. 364.
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- GELSTHARP, F., on "exothermic steel." 1913, i. 602.
- GENDERS, R.—
Paper on "The manufacture of shells in Canada during the war 1914-1918." See SWABEY, H. W. B.
elected member. 1921, ii. 9.
- GENEAU, C., on magnetic properties of manganese steels. 1917, ii. 445.
- GENES, on the Schiller tensile testing machine. 1914, i. 706.
- GENNET, C. W., JUN., on rail specifications. 1916, i. 382.
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- GENTIL, L., on origin of petroleum. 1921, ii. 354.
- GENZMER, R., on casting of large cylindrical rolls. 1911, ii. 570.
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- GEORGE, on petroleum in Hanover. 1913, ii. 551.
- GEORGE, CECIL WALTER, elected member. 1917, ii. 2.
- GEORGE, EDWARD JAMES, elected member. 1920, i. 3.
- GEORGE, G., on coal in India. 1917, ii. 364.

- GEORGE, H. C., on development of Appalachian, Lima and Texas oilfields. 1912, ii. 642.
- GEORGE, J. R., on development of merchant mill in United States. 1915, ii. 291.
- GEORGE, W., on working of petroleum. 1914, i. 613.
- GEORGE, W. H., on moisture in coke. 1920, i. 695.
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- GEORGIADSE, A., on petroleum in Moldavia. 1913, ii. 551.
- GEORGIUS, on electrical appliances for deep boring. 1914, i. 580.
- GERARD, on atomic weight of nickel. 1914, ii. 382.
- GERARD, A., on charging machine for cupolas. 1911, ii. 560.
- GERARD, C., on pulverised coal. 1920, ii. 321.
- GERBEL-STROVER, ERICH, elected member. 1911, ii. 9.
- GERBER, D., on ventilation in collieries. 1914, i. 627.
- GERBRACHT, E., on German rolling-mills. 1911, i. 614.
- GERCKE, F., on estimation of carbon in ferro-chromium. 1912, i. 608.
- GERCKE, M., on power supply in steelworks. 1913, ii. 632.
- GERDAU, B., on forging presses. 1911, ii. 573.
- GERHARD, W. P., on comparative value of cast iron, wrought iron and steel pipe. 1919, i. 683.
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- GERHARDT, R. B., on apparatus for hoisting furnace doors. 1919, ii. 499.
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- GERKE, A., on clay ironstone mines of Czenstochau. 1920, i. 670.
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- GERMEAU, NESTOR, elected member. 1914, ii. xix.
- GERNER, G. C., on cold-rolling of steel. 1916, ii. 439.
- GERRY, A. L., on methods of working iron ore. 1912, ii. 460.
- GERSTEN, E., on heat of formation of iron carbide. 1912, i. 586; 1913, i. 683.
- GESSNER, A., on impact tensile tests of special steels. 1920, ii. 383.
on impact tests on cast iron. 1915, ii. 309.
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- GEUZE, L., on manufacture of axles and tyres. 1918, i. 520.
- GEVERS-ORBAN—
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- GIBBS, A. W., on quick-bend tests for rails. 1918, i. 541.
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- GIBBS, G. H., on blast-furnace bears. 1918, i. 213.
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- GIBBS, W. E., on corrosion of iron and alloys. 1916, i. 391.

- GIBSON, A. E., on new aerial tramway for mining cliff coal. 1915, i. 535.
 GIBSON, C. B., on manufacture of electric ferro-alloys. 1920, i. 708.
 GIBSON, HESELTINE, elected member. 1920, i. 3.
 GIBSON, J., on economics of mining. 1914, i. 634.
 GIBSON, R. E., on transporting coke. 1915, i. 517.
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 on fatigue tests of aluminium alloys. 1920, ii. 392.
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 GIDANSKI, C. M., on corrugation of rails. 1914, i. 711.
 GIEBELHAUSEN, H., on vanadium-silicon compounds. 1915, ii. 319.
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 GIGLIUCCI, CONTE MARIO, elected member. 1911, i. 3.
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 GILBERT, C. G., on form value of energy. 1921, i. 381.
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 GILCHRIST, D. A., on basic slag as affecting agricultural development. 1917, i. 368.
 GILES, P., on use of meteoric iron by primitive man. 1916, ii. 351.
 GILL, A. C., on chromite in Alaska. 1921, i. 374.
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 GILLE, CARL HELMER, elected member. 1915, i. 1.
 GILLE, H., on German steelworks. 1911, ii. 584.
 GILLES, C., on cast iron briquettes. 1914, ii. 327.
 GILLES, T. W., on heat conductivity of firebricks. 1915, i. 499.
 GILLETT, H. W., on manufacture of ferro-uranium. 1917, ii. 452.
 on melting of aluminium scrap. 1917, i. 357.
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 GILLHAUSEN, W. G., on heat balance of blast-furnaces. 1911, i. 579.
 GILLIEAUX, M., on new system of lining mine shafts. 1915, i. 530.
 GILLIES, G. A., on haulage in iron ore mines. 1911, i. 528.
 GILLIGAN, A., on clays of Northern Yorkshire. 1917, i. 300.
 GILLIGAN, FRANK R., elected member. 1918, i. 3.
 GILLING, W. O. R., on brown coal in New Zealand. 1919, ii. 474.
 GILLMAN, F., on iron ore in Spain. 1911, i. 517.

- GILMAN, F., on origin of iron ore. 1911, i. 514.
- GILSON, R., on by-product coke-oven practice. 1912, i. 471.
- GILLOTT, JOHN FRANCIS, elected member. 1912, ii. 5.
- GILLOTT, JOSEPH PERCIVAL, elected member. 1913, ii. 4.
- GILLOTT, WILFRED MARSH, elected member. 1913, ii. 4.
- GILMAN, G. H., on heat treatment of rock drill steel. 1921, ii. 389.
- GILMONT, E. B., on moulding sand. 1912, i. 521.
- GILMORE, L. E., on cupola design. 1915, ii. 268.
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- GILMORE, T., on influence of briquetted borings on foundry products. 1918, i. 501.
- GILPIN, C. D., on handling iron ore. 1916, i. 300.
- GILPIN, J. E., on origin of petroleum. 1911, i. 552.
- GILTISAN, D. M., on metallurgy of high speed steel. 1921, ii. 388.
- GIOLITTI, F.—
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on malleable cast iron. 1911, i. 605.
on solubility of slag inclusions in molten steel. 1915, i. 618.
on steel castings. 1921, i. 439.
on woody and flaky steel. 1919, i. 692.
on woody fractures in transverse tests. 1919, ii. 213.
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- GIOLITTI, F., and F. CARNEVALI—
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- GIBARD, L., on calorimetry. 1917, ii. 361.
- GIRARD, M., on interallied specifications for aircraft. 1919, i. 688.
- GIBASOLI, DOMENICO, elected member. 1913, i. 2.
- GIBAUD, J. E., on automatic grabs. 1914, i. 582.

- GIROD, P., on armour-piercing projectiles. 1913, ii. 266.
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- GIROUSSE, on electrolytic corrosion. 1914, i. 736.
- GIRVIN, H. G., on dry air blast. 1914, i. 640.
- GJESSING, O., on iron ore handling. 1912, ii. 462.
- GJERS, L. F., obituary notice of. 1919, ii. 454.
- GLADWYN, SIDNEY CHARLES, elected member. 1915, i. 1.
- GLANTAWE, LORD (J. J. Jenkins, 1st Baron), obituary notice of. 1915, ii. 203.
- GLASER, E., on the Junkers calorimeter. 1915, i. 503.
- GLASER, L. C., on metallurgical reactions in Bessemer practice. 1920, i. 717.
- GLASSFORD, J., on constitution of cast iron. 1912, ii. 382.
- GLAZE BROOK, R. T., on laws of flow of oil through pipes. 1916, i. 320.
- GLEASON, A. C., on case-hardening. 1914, i. 689.
- GLEDHILL, J. M., on manufacture and treatment of steel for guns. 1912, i. 330.
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on treatment of high-speed tool steel. 1911, ii. 602.
elected Vice-President. 1915, i. 14.
- GLENECK, I., on automatic regulation of blast-furnace gas supply. 1913, ii. 581.
- GLENN, GEORGE, elected member. 1918, i. 3.
- GLENN, L. C., on petroleum in United States. 1920, ii. 334.
- GLINZ, K., on handling iron ore. 1911, i. 529.
- GLIWITZ, H., on iron and steel industry of Russia. 1911, ii. 677.
- GLOCKNER, on origin of coal. 1912, i. 461.
- GLUDD, W., on low-temperature carbonisation of coal. 1920, ii. 328.
- GLUSHKOW, I. N., on petroleum in Russia. 1913, i. 553.
- GMEYNER, E., on briquetting of brown coal. 1913, ii. 575.
- GOBIET, A., on by-product recovery in coking. 1911, ii. 512.
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- GODCHOT, M., on coke hardness. 1918, ii. 454.
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- GODDARD, CHARLES ERIC, elected associate. 1917, i. 5.
- GODFREY, C. E., on first steelworks in America. 1915, i. 555.
- GODFREY, EDWIN ANDERSON, elected member. 1920, i. 3.
- GODFROID, H., on reinforced basic lining for open-hearth furnace. 1917, ii. 354, 404.
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- GODSELL, JOHN CHARLES, elected member. 1918, ii. 2.
- GOEBEL, J., on flaky fracture in steel. 1921, i. 460.
- GOECKE, O., fusibility and volatilisation of refractory materials. 1912, i. 454.
on solubility of carbon in iron. 1911, ii. 644.
- GOERENS, F., on additional transformation points in steel. 1916, ii. 461.
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Paper on "The influence of cold-working and annealing on the properties of iron and steel." **C.S.M.**, 1911, iii. 320; introduction, 320; changes in the properties of iron and steel resulting from cold-working, 322; changes produced in cold-worked mild steel by heat-treatment, 379; conclusions, 396; summary, 399; tables, 400.

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on influence of thermal treatment on interstrained steel. 1914, i. 692.

on impact tests on steel at low temperatures. 1913, ii. 656.

on magnetic properties of iron-carbon and iron-silicon alloys. 1913, i. 669.

on measurement of gases in iron. 1915, i. 619.

elected member. 1914, i. 2.

awarded Carnegie Gold Medal. 1912, i. 26.

biographical notice of. 1912, i. 27.

GOETTEL, EMIL K., elected member. 1920, ii. 3.

GOETZ, A., on iron ore in Ontario. 1912, ii. 450.

GOETZE, R., on rock drills. 1911, i. 526.

GOLBLUM, H., on estimation of manganese. 1912, ii. 623.

GOLDMAN, J. M., on preservative treatment of timber. 1915, i. 531.

GOLDMANN, on use of fluorspar. 1920, i. 717.

GOLDMERSTEIN, L., on use of manganese fluoride in steelmaking. 1914, ii. 338; 1915, i. 571.

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GOLTZE, F., on magnetic properties of iron and iron alloys. 1913, ii. 676, 677.

GOLUBIATNIKOFF, D. W., on petroleum in Russia. 1917, ii. 373.

GOLYER, E. DE, on petroleum in Mexico. 1912, ii. 497, 638; 1914, ii. 300.

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- GOOD, T., on future of the steel trade. 1915, i. 661.
- GOOD, WILLIAM BARRETT, elected member. 1920, ii. 3.
- GOODALE, S. L., on Brinell hardness test. 1920, i. 741.
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- GOODALL, A., on coke-oven accessories. 1912, ii. 492.
- GOODALL, S. V., on welding. 1919, i. 679, ii. 514.
- GOODCHILD, W. H., on formation of ore deposits. 1919, i. 616; ii. 458.
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- GOODE, R. H., on geology of coal. 1913, i. 535.
- GOODIN, B. J., on coke manufacture. 1912, i. 471.
- GOODSON, H. E., on spectrum of iron. 1916, i. 399; 1917, i. 415.
- GOODWIN, J. T., on manufacture of shells. 1916, i. 363.
- GOODWIN, W. L., on calcining iron ore. 1911, ii. 493.
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- GORDON, C. H., on iron ore in Tennessee. 1913, i. 515.
- GORDON, C. S., on use of pyrometers in steelworks. 1912, ii. 473.
- GORDON, D., on foundry cores. 1914, ii. 329.
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- GORDON, FREDERIC DONALD, elected member. 1919, i. 3.
- GORDON, FREDERICK FELIX, elected member. 1919, i. 3.
- GORDON, J. M., on classification of coals. 1913, ii. 537.
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- GORDON, JOHN ROBERTSON, elected member. 1919, i. 3.
- GORDON, W., on influence of shape of test-bars. 1912, i. 559.
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- GORDON-SMITH, G., on mineral wealth of Jugo-Slavia. 1921, i. 372, 384.
- GORSKI, HENRI DE, elected member. 1912, ii. 5.
- GOSHIMA, on iron and steel industry in Japan. 1919, i. 703.
- GOSMAN, R. B., on reduction of iron oxides by platinum. 1915, i. 623.
- GOSROW, R. C., on coke as a reducing agent in the electric smelting furnace. 1916, ii. 420.
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- GOSS, W. F. M., on smoke abatement. 1917, i. 308.
- GOTHAN, W., on geology of coal. 1913, ii. 536.
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- GOTTSCHALK, A. L., on iron ore in Brazil. 1916, i. 294.
- GOUDSOW, N. T., on elastic limit of open-hearth steel. 1917, i. 401.
- GOVERE, A., on composition of petroleum. 1915, i. 519.
- GOUGE, P., elected member. 1921, i. 3.
- GOUGH, H. J., on fatigue testing. 1921, ii. 397.
- GOUJON, E., on cupola practice. 1911, ii. 559; 1912, ii. 538; 1913, i. 606.
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- GOUJON, JULES, obituary notice of. 1920, i. 665.
- GOUJON, L., on production of steel castings. 1913, ii. 601.
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- GOULD, C. N., on geology of natural-gas. 1912, ii. 500.
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- GOUSSKOFF, W., on coal washing. 1911, i. 577.
- GOUTAL, E., on estimation of carbon. 1911, ii. 656; 1912, ii. 618.
- GOUVY, A., on cleaning of blast-furnace gas. 1913, i. 587; 1914, i. 331; 1921, i. 404.
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- GOW, C. C., on the Nathusius electric furnace. 1912, i. 90.
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- GOWAN, ARTHUR BYRAM, elected member. 1915, i. 2.
- GOWER, WILLIAM EDWARD, elected member. 1919, i. 3.
- GOWLAND, W., on history of iron. 1913, i. 595.
- GOYON, J. DE, on steel making. 1918, i. 512.
- GRACE, E. G., on manufacture of ordnance. 1913, i. 652.
- GRACE, EUGENE G., elected member. 1914, ii. xix.
- GRACE, W. G., on methods of mining iron ore. 1920, ii. 312.
- GRADENWITZ, A., on blast-furnace operations. 1911, i. 580.
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- GRADY, W. H., on cost factors in coal production. 1915, i. 540.
- GRAEFFE, E., on asphalt in Trinidad. 1912, ii. 500.
- GRAEFF, S. H., on a universal strainometer. 1916, i. 372.
- GRAHAM, C., on the Draeger and Fleuse types of mine-rescue apparatus. 1915, i. 539.
- GRAHAM, C. S., on corrosion of coke-oven bricks. 1920, i. 683.
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- GRAHAM, J. J., on absorption of oxygen by coal. 1914, ii. 288; 1916, ii. 396.
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- GRAHAM, THE MARQUESS OF, elected member. 1917, i. 2.
- GRAHAM, T., on coal in Canada. 1917, ii. 366.
- GRAHAM, W. H., on coal washing. 1919, i. 645.
- GRAHN, H., on coal briquetting. 1912, ii. 519; 1913, i. 578.
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- GRAHN, H., on rescue appliances. 1912, ii. 516; 1914, i. 633.
- GRAMMER, F. L., on composition of blast-furnace slags. 1913, i. 597.
- GRANDMOUGIN, E., on purchase of coal on the heat unit basis. 1911, ii. 505.
- GRANELL, C., on tungsten ore in Spain. 1912, ii. 457.
- GRANGER, L. D., on wire drawing. 1921, i. 447.
- GRANGER, M. A., on sources and properties of zirconia. 1919, i. 626.
- GRANIGG, B., on coal in Austria. 1911, i. 543.
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- GRANT, DONALD ERNEST, elected member. 1919, i. 3.
- GRANT, E. P., on concentration of molybdenum ores. 1917, ii. 346.
- GRANT, GEORGE CHARLTON, elected member. 1917, ii. 3.
- GRARD, C., on determining hardness by the Brinell method. 1915, ii. 307.
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on hardness of steels. 1912, ii. 370.
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- GRASSI, L., on estimation of titanium. 1913, i. 692.
- GRASTY, J. S., on iron ore in Alabama. 1911, ii. 477.
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- GRAVE, E., on the passivity of metals. 1912, i. 596.
- GRAVES, C. H., on peat deposits in Sweden. 1911, ii. 511.
- GRAVES, H. G.—
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- GRAY, ANDREW, on basic open-hearth practice. 1920, i. 715.
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- GRAY, A. W., on determination of expansion in steel. 1912, ii. 607.
on electric furnace for heat-treatment. 1914, ii. 352.
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- GRAY, BASIL, elected member. 1918, i. 3.
- GRAY, B. D., on microstructure of ball-bearings. 1916, i. 388.
- GRAY, F. W., on coal in Canada. 1917, ii. 365.
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- GRAY, FRANK WEST, elected associate. 1917, i. 5.
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- GRAY, G. WATSON, on estimation of phosphorus. 1919, ii. 538.
- GRAY, G. WATSON, and JAMES SMITH—
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- GRAY, H. H., on flameless surface combustion. 1914, ii. 286.
- GRAY, J. G., on influence of heat-treatment on magnetic properties of nickel-manganese alloys. 1912, ii. 598.
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- GRAY, J. H., on electric furnace in the foundry. 1916, i. 340.

- GRAY, J. H., on steel foundry practice. 1915, ii. 280; 1917, i. 355.
- GRAY, T., on assay of coal. 1921, i. 386.
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- GRAY, W., on manufacture of firebricks. 1917, i. 297.
- GRAY, W. C., on strength of oxy-acetylene welds. 1914, ii. 361.
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- GRAY, WALTER G., elected member. 1917, ii. 3.
- GRAZEBROOK, OWEN FRANCIS, elected member. 1911, ii. 9.
- GREAVES, H. A., on electric furnace practice. 1919, i. 666; 1920, ii. 354.
- GREAVES, R. H., on coking practice in South Wales. 1912, ii. 490; 1913, i. 545.
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- GREAVES, R. H., (MISS) M. FELL, and SIR R. HADFIELD—
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- GREAVES-WALKER, A. F., on electric furnace refractories. 1921, i. 378.
- GREBEL, A., on by-product recovery. 1920, ii. 329; 1921, ii. 353.
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- GREEN, A. W. F., on heat-treatment of guns. 1920, i. 734.
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- GREEN, ERNEST SYLVESTER, elected member. 1915, ii. 2.
- GREEN, G. W.—
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- GREEN, H., on electrical equipment of collieries. 1917, ii. 383.
- GREEN, H. S., on foundry cores. 1912, ii. 545.
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- GREEN, PENROSE, speech of welcome at Leeds by. 1912, ii. 2.
- GREEN, R., on haulage in coal mines. 1917, i. 332.
- GREEN, S. S., on electric practice. 1921, ii. 377.
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- GREEN, V. D., on electric welding. 1913, i. 651.
- GREEN, WALTER JAMES, elected member. 1913, ii. 4.
- GREEN, W. J. S., on electric furnace practice. 1921, ii. 377.
- GREENAWALT, W. E., on the Greenawalt sintering process. 1921, i. 376.
- GREENE, A. E., on duplex electric process. 1911, i. 625.
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- GREENE, A. M., on malleable castings. 1920, ii. 352.
- GREENER, T. Y., on by-product coke-ovens. 1915, ii. 236.
- GREENLEAF, W. B., on bluing steel. 1918, ii. 486.
- GREENSMITH, THOMAS, elected member. 1918, ii. 2.
- GREENWELL, G. H., on coal in India. 1913, i. 538.
- GREENWOOD, H. C.—
Paper on "A curious case of decarburisation during the hardening of steel dies." 1914, i. 508.
- GREENWOOD, J. N.—
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- GREGG, E. T., on improved compensator for gas analysis. 1917, ii. 469
- GREGORY, EDWIN, JUN., elected associate. 1917, i. 5.
- GREGORY, H. E., on petroleum in the United States. 1911, i. 556.
- GREGORY, J., on use of concrete in mines. 1913, ii. 564.
- GREGORY, J. W., on conservation of coal. 1920, ii. 320.
- GREGORY, T. W. D., on coal-sampling. 1915, i. 635.
- GREGSON, J., on linings for small converters. 1914, ii. 327.
- GREGSON, W., on gas-fired boilers. 1921, ii. 358.
- GREIG, EDWARD COCKBURN, elected member. 1917, i. 2.
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GRENFELL, D. S., on optical pyrometers. 1916, i. 305.

GRENIER, GEORGES, elected member. 1918, ii. 2.

GRENNAN, J., on foundry work at Nebraska University. 1917, i. 347.

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GRESTY, COLIN, elected associate. 1919, i. 6.

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GREY, HENRY, obituary notice of. 1913, i. 487.

GRIER, C. D., on electric smelting of manganese ore. 1920, ii. 345.

GRIERSON, J., on wear of rails. 1912, i. 571.

GRIFF, (MISS) CLEONE DE HEVINGHAM, B. elected member. 1921, ii. 9.

GRIFFIN, G. E., on separation of uranium and vanadium. 1912, ii. 626.

GRIFFIN, THOMAS A., obituary notice of. 1915, i. 458.

GRIFFIS, R. O., elected member. 1920, i. 3.

GRIFFITH, D. M., on coke-oven construction. 1911, ii. 512.

GRIFFITH, J. H., on tests of wire ropes. 1919, ii. 526.

GRIFFITH, J. P., on coal handling. 1917, i. 335.

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GRIFFITH, W. T., on coal in the United States. 1911, ii. 510.

GRIFFITHS, A., obituary notice of. 1911, i. 497.

- GRIFFITHS, E., on calorimetry. 1914, i. 591.
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- GRIFFITHS, E. C., on tests of refractories. 1917, i. 292, 304.
- GRIFFITHS, E. H., on specific heat of metals. 1915, i. 622.
- GRIFFITHS, F. J., on chromium-vanadium steel. 1917, ii. 450.
- GRIFFITHS, H. D., on tungsten ore. 1917, ii. 343.
- GRIFFITHS, WILLIAM THOMAS, elected member. 1921, ii. 10.
- GRIGOROWITCH, K. P., on electrolytic corrosion of iron. 1916, i. 394.
- GRIMNES, FREDRIK BERG, elected member. 1920, i. 3.
- GRIMSHAW, R., on mixing foundry core sand. 1919, i. 659.
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- GRINDLE, A. J., on pulverised coal. 1920, i. 689.
- GRINE, H. A., on producer-gas from crude oil. 1912, i. 483.
- GRISWOLD, W. A., on cupola linings. 1914, i. 657.
- GROECK, H., on American blast-furnaces. 1912, ii. 527.
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- GROELING, A. E. VON, on petroleum in Scotland. 1913, ii. 551.
- GROESBECK, E. C., on arc-welding. 1921, i. 444.
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- GRÖNDAL, G., on briquetting iron ore. 1911, ii. 490.
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- GRONEMAN, J. L. T., on cupola-charging. 1912, ii. 538.
- GROOM, T., on geology of the Forest of Dean. 1917, ii. 363.
- GROSCH, P., on iron ore in Spain. 1912, ii. 449.
- GROSCLAUDE, M., on manganese content of metal for ingot moulds. 1920, ii. 353.
- GROSS, C., on manufacture of wrought-iron pipe. 1914, ii. 350.
- GROSS, I. W., on electrolytic corrosion. 1914, ii. 387.
- GROSSMAN, M. A., on embrittling effects of pickling. 1920, i. 755.
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- GROSSPIETSCH, O., on magnesite. 1911, ii. 499; 1913, ii. 530.
- GROSSWENDT, C., on turbo-blower regulators. 1917, i. 340.
- GROTEWOLD, C., on petroleum in Argentina. 1914, i. 612.
- GROTTS, F., on heat-treatment of aeroplane steel. 1918, ii. 484; 1919, i. 674, ii. 508.
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- GROUME-GRJIMAILO, on application of laws of hydrostatics to flames. 1921, i. 431.
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- GROUME-GRIJMAILLO, on manufacture of dinas bricks. 1911, ii. 497.
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- GROUND, A., on agglutinating power of coal. 1920, i. 695.
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- GROUT, F. F., on composition of coal. 1912, i. 462.
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- GRUBE, C., on theory of passivity. 1914, i. 737.
- GRUBER, K., on manufacture of seamless tubes. 1920, i. 736; 1921, i. 446.
- GRUGAN, J. F., on chrome sands on the Pacific Coast. 1919, i. 624.
- GRUMMITT, W. C., on structure of coal. 1914, ii. 288.
- GRUN, R., on corrosion of reinforced bars. 1921, ii. 418.
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- GRUNDY, G. ERIC LEIGH, elected member. 1920, i. 3.
- GRUNDY, G. G. S., remarks at meeting by. 1915, i. 17.
- GRUNER, E., on devastated coalfields in France. 1920, ii. 324.
- GUBKIN, I., on petroleum in Russia. 1917, ii. 373.
- GUDGEON, C. W., on tungsten in New Zealand. 1916, ii. 382.
- GUÉDRAS, M., on cast iron from pyrites cinders. 1921, ii. 371.
- GUENEAU, T., on classification of foundry iron. 1914, i. 658.
- GUERTLER, W., on Belaiew's studies on the structure of steel. 1915, i. 620.
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- GUEST, HENRY C., elected member. 1920, i. 3.
- GUEST, JOSIAH, obituary notice of. 1915, ii. 204.
- GUEST, J. J., on grinding. 1916, i. 356.
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- GUGGENHEIM, S., on manufacture of steel in the electric furnace. 1914, ii. 340.
- GUGLER, H., on hot-blast stoves. 1911, i. 582.
- GUILD, J., on self-magnetisation of steel. 1912, ii. 600.
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- GUILLAIN, A.—
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 on expansion of iron-nickel alloys. 1917, ii. 447.
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- GUILLAUME, C. H., on "Invar" metal. 1917, i. 405.
- GUILLAUME, E., obituary notice of. 1913, i. 487.
- GUILLEMAIN, C., on iron ore in Uruguay. 1911, i. 522.
- GUILLERY, R., on application of the aphegraph in testing. 1912, i. 568; 1913, i. 656.
 on coal-washing. 1911, i. 577.
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- GUILLET, L.—
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- GUINOTTE, LEON, elected member. 1914, i. 2.
- GUISELIN, A., on oil-shale industry in France. 1919, ii. 477.
- GÜLICH, on apparatus for gas analysis. 1911, ii. 669.
- GULLACHSEN, B. C., on methods of working in collieries. 1911, ii. 529.
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- GULLIVER, G. H., on influence of shape of test bars. 1912, i. 559.
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- GUMÆLIUS, ARVID, elected member. 1911, i. 3.
- GUMBERZ, A. VON, on ferro-silicon explosions. 1912, i. 591.
- GUMMICH, E., on chromium steel for magnets. 1917, i. 411.
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- GUMMER, HAROLD, elected associate. 1919, ii. 5.
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- GUNDERSON, R., on American by-product coke industry. 1919, ii. 475.
- GUNNIS, M., on coal-cutting machinery. 1917, ii. 383.
- GUNNISS, W. H., on occurrence and manufacture of refractories. 1913, ii. 526.
- GUNSOLUS, F. H., on explosives and blasting. 1911, i. 565.
- GUNTHER, H., on estimation of manganese. 1912, ii. 623.
- GUREVICH, L. J., on graphitisation of white cast iron. 1919, ii. 516.
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- GURURTSCH, L., on chemistry of petroleum. 1911, ii. 517.
- GUSTAVSON, R. G., on determination of cobalt. 1917, i. 423.
- GUTHRIE, R. G., on recovery in metals. 1920, ii. 381.
- GUTMANN, J., on electric rolling-mills. 1913, i. 639, ii. 630.
- GUTTMANN, A., on cement from blast-furnace slag. 1917, ii. 395.
- GUY, HENRY AUGUSTUS, obituary notice of. 1915, i. 459.
- GUYE, P. A., on atomic weight of nitrogen. 1911, i. 690.
- GWIGNER, A., on by-products from gas-producers. 1912, i. 483.
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on influence of temperature on valuation of fuel. 1913, ii. 535.
- GWILLIM, J. C., on chromite in Quebec. 1921, i. 371.
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- GWOSDZ, on the De Fontaine and Belzinger gas-producers. 1914, i. 618.
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on gasification of liquid fuel. 1913, i. 565.
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on the Moore gas-producer. 1913, ii. 561.
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- GWYER, A. G. S., on conductivity of metals. 1913, ii. 678.
- GWYER, ALFRED GEORGE C., elected member. 1914, ii. xix.
- GWYNNE, J. H., on conditions of working in American tinplate industry. 1914, i. 377.
- GWYNNE, RALPH HAROLD, elected member. 1911, i. 3.

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- HAAGE, on briquettes. 1914, i. 586.
- HAANEL, B. F., on comparative value of peat fuel. 1916, ii. 394.
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 on manufacture of peat fuel. 1915, i. 513.
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- HAANEL, E., on Canadian peat industry. 1911, ii. 511.
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- HAARMANN, A., on history of rail-making. 1913, i. 649.
- HAAS, A. L., on design of standard steel sections. 1916, i. 354.
- HAAS, F., on coal-dust experiments. 1915, i. 538.
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- HABETS, MARCEL, elected member. 1913, ii. 4.
- HABETS, P., on search for coal. 1911, i. 541.
- HACHITA, M. S., on analysis of coal. 1913, i. 695.
 on shaft-sinking. 1911, i. 564.
- HACKENBERGER, B. L., on Siemens electric welding process. 1913, ii. 643.
- HACKETT, E. F., on coal in the United States. 1915, ii. 234.
- HACKETT, R., on gas-heated furnaces for heat-treatment. 1916, ii. 441; 1917, i. 379.
- HACKFORD, J. E., on formation of coal. 1921, i. 385.
- HACKL, O., on estimation of iron in iron ore. 1919, ii. 540.
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- HACKNEY, NORMAN, elected member. 1921, ii. 10.
- HACKSPILL, L., on recovery of tin from tinplate. 1920, ii. 378.
- HADDOCK, J. T., on corrosion of iron and steel pipes. 1912, ii. 612.
- HADDOW, T., on electroplating with cobalt. 1915, ii. 327.
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on cooling of steel in ingot and other forms. 1918, ii. 278.

on cooling velocities of chromium steel. 1916, i. 145.

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on hardening of metals. 1914, i. 250; 1915, ii. 305.

on hardening and tempering of high-speed steel. 1915, ii. 33.

on hardening cracks in tool steel. 1921, i. 228.

on hardness of metals. 1914, ii. 368.

on hardness testing. Introduction and commentary to paper by A. F. Shore. 1918, ii. 57.

on heat-treatment of steel. 1921, ii. 137.

on history of metallurgy of iron and steel. 1915, i. 555.

on history of steelmaking. 1914, ii. 368.

on influence of carbon on iron and manganese alloys. 1911, ii. 81.

on influence of elements on mechanical properties of steel. 1916, ii. 100.

on influence of hot-deformation on qualities of steel. 1918, ii. 30.

on influence of mass on heat-treatment. 1918, i. 349.

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on influence of temperature on carbon and pig iron. 1911, ii. 100.

on magnetic analysis of manganese steel. 1921, i. 462.

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on magnetic properties of manganese steels. 1915, i. 616; 1917, ii. 445.

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- HADFIELD, SIR ROBERT, on non-metallic inclusions in steel. 1918, i. 300.
 on occlusion of gases in metals. 1919, i. 689.
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HAER, C., on manganese ore in South Carolina. 1915, i. 488.

HAGA, T., on coal in Japan. 1911, ii. 508.

HAGAN, G. T., on reheating furnaces. 1919, i. 672.

HAGAR, E. M., on agglomeration of fine ore. 1911, ii. 492.

HAGER, D., on geology of petroleum. 1911, ii. 513.

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on petroleum in the United States. 1918, ii. 456.

on petroleum mining. 1912, ii. 499; 1919, i. 643.

HAGMAIER, E. W., on estimation of titanium. 1917, ii. 468.

HAGUE, A. P., on woody fractures in transverse tests. 1919, ii. 223.

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HAGUE, EDWARD WILSON, elected associate. 1917, i. 5.

HAHN, C., on driving of rolling-mills. 1913, ii. 632.

on moulding sand. 1911, ii. 567.

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HAIDER, F. L., on value of peat fuel. 1917, ii. 367.

HAIGH, B. P., on alternating load tests. 1912, ii. 591.

on endurance of metals under alternating stresses. 1916, i. 373.

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HAIGH, F. L., on test for carbon in minerals. 1917, ii. 467.

HAIGHT, H. V., on procuring special machines for munitions manufacture. 1917, ii. 428.

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Paper on "An investigation of liquid contraction in cast iron." **C.S.M.**, 1913, v. 51; introduction, 51; general scheme, 54; author's research, 58; summary, 69.

Paper on "An investigation of liquid contraction in cast iron." Part II. **C.S.M.**, 1916, vii. 55.

on application of the microscope in foundry work. 1911, i. 606.

- HAILSTONE, G., on methods of testing. 1913, i. 655.
on use of alloy steels. 1914, i. 712.
elected member. 1914, ii. xix.
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- HAILSTONE, H. J., on specific gravity of coal. 1921, i. 386.
- HAILWOOD, E. A., on miners' lamps. 1914, i. 628, ii. 313.
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- HAKE, H. W., on manufacture and uses of ferro-chromium. 1914, ii. 341.
- HALBAUM, H. W. G., on automatic distribution of stone-dust. 1914, i. 630.
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- HALBERTSTADT, B., on search for coal. 1911, i. 541.
- HALDANE, J. S., on gases in coal-mines. 1911, ii. 532.
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- HALDANE-GEE, on Manchester and the smoke problem. 1916, i. 308.
- HALE, F. A., on manganese in the United States. 1918, ii. 432.
- HALE, H., on petroleum in the United States. 1911, ii. 514.
- HALE, HAROLD GODFREY, elected member. 1916, i. 3.
- HALER, P. J., on hardness testing of steel. 1913, i. 660.
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- HALEY, D. F., on molybdenite in the United States. 1918, ii. 433.
- HALEY, M., on signalling in collieries. 1911, ii. 536.
- HALL, A. E., on estimation of volatile matter in coal. 1912, ii. 628.
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- HALL, A. EGERTON, re-elected member. 1912, ii. 5.
- HALL, A. L., on chromite deposits of South Africa. 1912, ii. 454.
on iron ore in South Africa. 1912, ii. 449.
- HALL, C., on blasting by electricity. 1912, ii. 510.
on explosives for mining operations. 1913, ii. 566.
on testing explosives. 1912, ii. 385.
- HALL, D., on electric driving of rolling-mills. 1916, ii. 437.
- HALL, E., on chrome iron ore as a furnace lining. 1916, i. 304.
- HALL, ERNEST BYFIELD, elected member. 1912, ii. 5.
- HALL, F. C., on electric control gear for steelworks. 1913, i. 637.
- HALL, F. E., on semi-steel for shells. 1920, ii. 354.
- HALL, HEWITSON, elected member. 1920, i. 3.
- HALL, H. G., on pyrometry. 1921, ii. 384.
- HALL, ISAAH, elected member. 1918, i. 3.
- HALL, JOHN AINGER, elected associate. 1917, i. 5.
- HALL, JOSEPH, memoir of. 1917, i. 345.
- HALL, J. F., on coal in Queensland. 1919, ii. 473.
- HALL, J. H., on crucible steel furnaces. 1913, ii. 611.
on defects in ingots and castings. 1914, ii. 329; 1915, ii. 286; 1919, ii. 500.
on the Fremont test for cast steel. 1913, ii. 655.
on general foundry practice. 1917, i. 347.
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on manufacture of crucible steel. 1913, ii. 611.
on manufacture of manganese steel castings. 1913, ii. 601.
on manufacture and properties of manganese steel. 1915, i. 613.

- HALL, J. H., on physical tests of rolled steel. 1919, i. 685.
 on properties of steel castings. 1920, ii. 352; 1921, i. 440.
 on steel-making practice. 1921, i. 419.
 elected member. 1913, i. 2.
- HALL, J. J., on equipment of collieries. 1914, i. 623.
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- HALL-BROWN, ARCHIBALD, elected member. 1917, ii. 3.
- HALL-BROWN, E., on blast-furnace gas purification. 1914, i. 335.
- HALLA, F., on corrosion of wrought-iron nails. 1913, i. 686.
- HALLBÄCK, A., on coal-washing. 1911, i. 577.
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- HALLETT, R. L., on estimation of nickel and cobalt. 1913, ii. 705.
- HALLIMOND, A. F.—
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Paper on "Action of iron oxides upon the acid furnace structure." See WHITELEY, J. H.
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- HALSEY, A. F., on materials and constructions for resisting shock. 1915, ii. 314.
- HAMABE, G., on elasticity of cast iron. 1915, ii. 300.
- HAMBLY, P. N., on manufacture of coke. 1913, ii. 57.
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- HAMILTON, D. T., on electric welding. 1915, ii. 297.
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- HAMILTON, JAMES, elected member. 1917, ii. 3.
- HAMILTON, J. W. H., on agglomeration of iron ores. 1913, i. 525.
- HAMILTON, R., on cleaning of blast-furnace gases. 1912, i. 502.
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- HAMILTON, W. R., on gas from oil wells. 1919, i. 643.
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- HAMILTON, W. S., on action of fluorspar on open-hearth slags. 1915, i. 571.
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- HAMMOND, CHARLES F., elected member. 1919, i. 3.
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HAMMOND, E. K., on cleaning blast-furnace gases. 1912, ii. 524.
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HAMNER, H. L., on estimation of chromium and vanadium in steel. 1917, ii. 467.
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HAMOR, W. A., on American oil-shales. 1913, ii. 553.
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HANAUER, W., on sanitation in collieries. 1911, i. 575.
HANBY, W., on treatment of special steels. 1915, ii. 295.
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HANCOCK, E. L., on elastic strength of structural shapes. 1911, ii. 616.
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HANCOCK, E. T., on petroleum in Wyoming. 1920, ii. 332; 1921, i. 392.
HANCOCK, R. T., on storage of iron ore. 1911, i. 529.
HANCOCK, WALTER C.—
Paper on "Report of the investigation into the properties of refractory materials used in coke-oven construction." *C.S.M.*, 1920, x. 41.
on properties of refractory materials used in the iron and steel industry. 1917, i. 63.
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HAND, S. A., on manganese steel. 1921, i. 441.
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HANEY, M., on manganese ore in United States. 1919, i. 622.

- HANICOTTE, A., on shaft-sinking. 1911, i. 564.
- HÄNIG, A., on sources of supply of manganese ore. 1914, i. 576.
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- HANLEY, H. B., on preparation of foundry sand. 1919, i. 659.
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- HANMER, C., on modern regenerative breathing apparatus. 1915, i. 539.
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- HANSON, H. H., on corrosion of iron and steel. 1912, ii. 609.
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- HANSON, JOHN HENRY, elected member. 1918, ii. 3.
- HANUS, J., on estimation of chromium. 1913, ii. 701.
- HARBIT, W. D., on methods of working coal. 1917, ii. 384.
- HARBORD, F. W., on Belgian iron and steel industry and the Great War. 1919, i. 44.

- HARBORD, F. W., on cleaning blast-furnace gas. 1920, ii. 86; 1921, i. 98.
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- HARBORD, VERNON, elected member. 1921, ii. 10.
- HARBORT, E., on origin of iron ore. 1911, ii. 469.
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- HARDEL, J. A., on mining of petroleum. 1921, ii. 354.
- HÄRDÉN, J., on electric crucible furnace. 1913, ii. 612.
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- HÄRDÉN, P., obituary notice of. 1921, ii. 329.
- HARDER, E. C., on chromite in California. 1911, i. 524.
on direct production of iron in Brazil. 1915, i. 557.
on iron-depositing bacteria. 1920, i. 668.
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- HARDER, O. E., on alloys of chromium-copper-nickel. 1917, i. 405.
- HARDESTY, S., on stresses in wire rope. 1919, ii. 526.
- HARDING, J. BRUCE, elected member. 1917, ii. 3.
- HARDING, R. C., on fuel economy. 1919, ii. 118.
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- HARDISON, S. J., on dehydrating petroleum. 1915, i. 524.

- HARDWICK, FRED, elected member. 1911, i. 3.
- HARDWICK, F. W., on history of the safety-lamp. 1916, ii. 412.
- HARDY, T. W., on heat-treatment of tool steel. 1917, i. 384.
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- HARDY, WALTER, elected member. 1917, ii. 3.
- HARDYMAN, T. F., on foundry patterns and moulding. 1912, i. 519.
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- HARGER, J., on chemistry of coal-mining. 1913, ii. 570.
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- HARKER, G., on analysis of toluene and benzene in coal-tar oils. 1917, i. 424.
- HARKER, J. A., on high-temperature furnace laboratories. 1916, i. 358.
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- HARLEY, A., on iron for piston rings. 1921, ii. 369.
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- HARMAN, E. A., on storage and heating of coal. 1912, i. 490.
- HARMOOD-BANNER, J. S., speech at Dinner by. 1911, i. 490.
- HARNECKER, K., on phosphorus etching reagent. 1919, i. 690.
- HARNICKELL, W., on disintegration of slag. 1917, ii. 396.
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- HARPER, C. H., on electro-plating with cobalt. 1915, ii. 327; 1916, i. 366.
- HARPER, L. F., on the coke industry of New South Wales. 1917, i. 319.
- HARFSTER, W. C., on combustion of lignite. 1919, i. 636.
- HARRINGTON, J., on use of pulverised coal. 1917, i. 306; 1918, i. 480.
- HARRINGTON, R. F., on utilising burnt sand. 1918, i. 506.
- HARRIS, GEORGE, elected member. 1918, i. 3.
- HARRIS, G. D., on petroleum in the United States. 1911, i. 556.
- HARRIS, G. W., on bee-hive oven construction. 1919, ii. 474.
- HARRIS, HOWARD EDWARD, elected member. 1913, ii. 4.
- HARRIS, H. H., on boxes used in carbonising. 1920, i. 730.
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- HARRIS, W. J., on heat-treatment furnace with surface combustion. 1919, ii. 511.
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- HARRISON, A., on briquetting of steel turnings. 1919, i. 659.
- HARRISON, D., on lighting of rolling-mills. 1912, i. 533.
- HARRISON, G. B., on accidents in coal mines. 1912, i. 489.
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- HARRISON, J. H., on use of pulverised coal. 1919, i. 122.
 HARRISON, N. C., on use of pulverised coal. 1919, ii. 469.
 HARRISON, REGINALD BARKER, elected member. 1918, i. 3.
 HARRISON, STANLEY BENJAMIN, elected member. 1918, i. 3.
 HARRISON, S. H., on use of pulverised coal. 1916, i. 306.
 HARRISON, T. R., on nichrome-constantan thermocouple. 1917, ii. 360.
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 HARRISON, W., on determination of carbon-dioxide in coal. 1921, i. 473.
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 HARRISON, W. B., obituary notice of. 1912, i. 410.
 HARRISON, WILLIAM GOLDSBROUGH, elected member. 1913, i. 2.
 HART, E. C., on rock drills. 1914, ii. 275.
 HART, J. F., on a jolt ramming machine. 1913, i. 614.
 HART, L. O., on nickel-chrome alloys. 1921, i. 467.
 HARTEL, G., on impact tests on steel at low temperatures. 1913, ii. 656.
 HARTERT, LOUIS, elected member. 1920, i. 3.
 HARTLAND, HARRY, elected member. 1921, i. 3.
 HARTLEB, on constitution of basic slag. 1912, ii. 559.
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 HARTLEY, HAROLD, elected member. 1912, ii. 5.
 HARTLEY, H. J., on hydraulic riveting of boilers. 1912, ii. 579.
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 on by-product recovery. 1913, ii. 549.
 HARTMANN, L., on permanent deformation of stretched metal. 1911, ii. 615.
 HARTMANN, M. L., on electro-analysis. 1911, i. 684.
 on physical characteristics of refractories. 1920, i. 681, ii. 317; 1921, ii. 342.
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 HARTMANN, P., on cases of band structure in iron and steel. 1914, ii. 365.
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 HARTWIG, E. H., on inclusions in steel. 1921, i. 429.
 HARVARD, F. T., on manufacture of firebricks. 1913, ii. 526.
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 HARVEY, ARTHUR HOUNSELL, elected member. 1919, i. 3.
 HARVEY, E. W., on gas-producers. 1915, ii. 250.
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HARVEY, RICHARD PERRY CALVER, elected member. 1920, i. 4.

HASIMOTO, H., on elasticity of steel. 1921, ii. 402.

HASKINS, C. N., on formation of producer-gas. 1911, ii. 522.

HASKINS, F. D.—

Paper on "The effect of heat-treatment on the colorimetric test for carbon in a 0.32 carbon steel." *See* CAMPBELL, E. D.

HASLAM, FRANK, elected associate. 1919, ii. 5.

HASLAM, SIDNEY BERTRAM, elected member. 1920, ii. 3.

HASLER, O., on manufacture of synthetic pig iron. 1920, i. 708.

HASTINGS, J. M., JUN., on by-product coke-ovens. 1920, ii. 331.

HATCH, A. S., on electric welding. 1911, ii. 603.

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Paper on "Influence of vanadium upon physical properties of cast irons." 1911, i. 318; introduction, 318; author's experiments, 321; heat-treatment experiments, 324; conclusions, 325.—*Discussion*: I. E. Lester, 326; J. Kent Smith, 326; J. E. Stead, 328.—*Correspondence*: H. Brearley, 328; H. C. H. Carpenter, 328; W. H. Hatfield (reply), 330.

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- HATFIELD, W. H., on acid open-hearth steel. 1917, ii. 219.
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- HATFIELD, W. H., on phosphorus in malleable cast iron. 1918, ii. 369.
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- HATT, H. L., on synthetic cast iron. 1921, i. 405.
- HATT, W. K., on tests of manufactured articles. 1912, ii. 387.
- HATTON, G., on alteration of bye-laws. 1915, ii. 4; 1916, i. 18.
- HATTON, WILLIAM HOWARD BRINTON, elected member. 1920, ii. 4.
- HATTORI, SUSUMU, elected member. 1911, i. 3.
- HATZFIELD, on lighting of collieries. 1912, ii. 514.
- HAUGHTON, H. L.—
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- HAUGHTON, JOHN LESLIE, on high-temperature thermostats. 1917, ii. 361.
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- HAULMAN, J. W., on refractories for use in steelworks. 1917, ii. 350; 1918, ii.
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- HAULTAIN, A. G., on methods of working in collieries. 1911, i. 566.
- HAULTAIN, H. E. T., on methods of concentrating molybdenum ores. 1918, i.
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- HAUSENFELDER, R., on tar-oil as fuel in foundries. 1913, ii. 600; 1914, i. 660.
 on value of coal-tar oils. 1912, ii. 475.

- HAUSER, E., on explosions in collieries. 1911, i. 573.
- HAUSSMANN, K., on deep boring. 1914, ii. 275.
- HÄUTPICK, E. DE, on manganese ore in Russia. 1912, ii. 456.
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- HAVERFIELD, F., on Roman iron found at Corstopitum. 1912, i. 132.
- HAWARD, W. A., on gaseous combustion at high temperatures. 1921, ii. 357.
- HAWDON, W., on desiccation of air by calcium chloride. 1911, i. 47.
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- HAWKE, C., on characteristics of abrasives. 1915, i. 582.
- HAWKE, C. E., on carborundum products. 1916, i. 304.
- HAWKINS, L. A., on protective coatings for iron. 1915, i. 628.
- HAWKRIDGE, LESLIE D., elected member. 1913, i. 2.
- HAWLEY, F. G., on determination of silica. 1917, ii. 467.
on determination of sulphur trioxide in flue-gas. 1913, i. 696.
- HAWLEY, T. H., on classification of pig iron. 1911, ii. 556.
- HAWORTH, E., on petroleum statistics of United States. 1912, ii. 642; 1914, ii. 299.
- HAYDEN, E. M., JUN., on separation of zirconium from iron and titanium. 1914, ii. 395.
- HAYDEN, H. H., on mineral industry of India. 1913, ii. 717; 1915, ii. 342.
- HAYDEN, J. L. R., on electrolytic corrosion. 1912, i. 593.
- HAYES, A., on cupola practice. 1918, ii. 466.
- HAYES, A. O., on iron ore in Newfoundland. 1916, i. 292.
- HAYES, C. W., on iron ore in Cuba. 1911, ii. 480.
- HAYES, F. A., on moulding sands. 1919, ii. 492.
- HAYES, H. H., on relation between ball hardness and scleroscope hardness. 1918, ii. 82.
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- HAYES, J. S., on coal in Nigeria. 1920, ii. 326.
- HAYNES, E., on cobalt, chromium and molybdenum alloys. 1913, i. 670.
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- HAYNES, JEROME KING, elected member. 1919, i. 3.
- HAYWARD, C. R., on appliances for metallography. 1912, i. 579.
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- HAYWARD, M. W., on molybdenite in the United States. 1918, ii. 433.
- HAYWARD, R. A., on heat-treatment of steel. 1919, ii. 507.
- HAYWARD, THOMAS PERCY, elected member. 1918, i. 3.
- HAZEN, A., on steel and cast-iron pipes. 1911, ii. 622.
- HAZLEDENE, F., on welding processes. 1919, i. 667.
- HAZLETT, A. J., on production of petroleum in Texas and Louisiana. 1915, i. 651.
- HEAD, B. W., on blast-furnace operations. 1912, i. 496.
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- HEADDEN, W. P., on meteorites. 1912, i. 443.
- HEAL, C., on mine drainage. 1916, ii. 411.
- HEALD, K. C., on petroleum in the United States. 1916, i. 317; 1917, i. 322.
- HEAP, RAY DOUGLAS THEODORE, elected member. 1914, ii. xix.
- HEAP, W., on equipment of the steel foundry. 1914, ii. 328.
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- HEATH, R. F., on estimation of tungsten. 1921, i. 472.
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- HEATHER, H. J. S., on explosions in collieries. 1911, ii. 534.
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- HEAVEN, GEORGE SAMUEL, on effect of mass on heat-treatment. 1918, i. 350.
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- HEBUR, A. E., on ironworks in Japan. 1911, ii. 547.
- HECHT, H. N., on estimation of iron and manganese. 1921, ii. 421.
- HECK, C., on by-product recovery. 1913, i. 548, ii. 548.
- HECKEL, W., on ammonia recovery. 1913, ii. 548.
- HECZKO, A., on estimation of sulphur. 1912, i. 610.
- HEDLEY, JOHN, elected member. 1917, ii. 3.
- HEDLEY, R. R., on coal in Canada. 1912, i. 467.
- HEER, E., on a special recording calorimeter. 1915, i. 504.
- HEFFNER, B., on analysis of titaniferous iron ores. 1912, i. 610.
- HEGDEM, A. G., on control of petroleum wells. 1916, i. 320.
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- HEGGIE, C., on cooling of cast iron. 1915, i. 595.
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- HEIBY, C. G., on hardening steel. 1911, ii. 598.
- HEIDELBERGER, M., on estimation of manganese. 1911, i. 686.
- HEIKE, W., on desulphurisation of iron. 1913, ii. 577.
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- HEINISCH, W., on graphite. 1911, ii. 499.
- HEINRICH, F., on piping in ingots. 1921, ii. 379.
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- HELBIG, A. B., on coal-dust firing. 1916, i. 307.

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 HELLMANN, E., on electric equipment of collieries. 1911, ii. 528.
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 HEMENWAY, H., on influence of elements on malleable castings. 1914, ii. 332.
 HEMINGWAY, E. H., on surface changes of steel. 1921, i. 438.
 HEMMING, R. N., on tests of car axles. 1917, i. 409.
 HEMMINGS, ISAAC, elected member. 1914, i. 2.
 HEMPRICH, F., on iron ore in Austria. 1911, i. 514.
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 HEMSTREET, H. E., on heat-treatment of springs. 1920, i. 736; 1921, ii. 390.
 HENDERSON, SIR ALEXANDER, BART., speech at Dinner by. 1913, i. 480.
 HENDERSON, C., on application of electric welding to shipbuilding. 1919, i. 678.
 HENDERSON, CHARLES W. C., obituary notice of. 1915, i. 459.
 HENDERSON, H. G., on mine surveying. 1912, i. 491, ii. 459; 1913, i. 520.
 HENDERSON, J. A. L., on natural gas industry. 1916, i. 321.
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 HENDERSON, J. F., on magnet steel. 1915, i. 617.
 HENDERSON, JOHN MACDONALD, elected member. 1921, i. 3.
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- HERBERT, THOMAS MARTIN, elected associate. 1921, ii. 11.
- HERBING, on coal briquetting. 1915, ii. 256.
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- HERBST, F., on coke manufacture. 1911, i. 550.
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- HERDEGEN, R. T., on manufacture of drop forgings. 1916, ii. 436.
- HERDSMAN, W. H.—
Paper on "The organic origin of the sedimentary ores of iron and of their metamorphosed forms; the phosphoric magnetites." 1911, i. 476.
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- HERING, C., on consumption of electric energy in electric steel furnaces. 1912, i. 538.
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- HERIOT, E. M., on shaft sinking in iron ore mines. 1912, i. 443.
- HERMAN, H., on coal resources of Victoria. 1915, i. 511.
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- HERMANN, T., on corrosion. 1915, i. 625.
- HERMANN, H., on coal-handling. 1911, ii. 538.
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- HERRMAN, M., on pressure on rolls of rolling-mills. 1912, i. 530.
- HERRMANN, S., on microstructure of metallic silicides. 1911, i. 664.
- HERRON, J. H., on die blocks. 1921, i. 442.
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- HERRON, J. H., on special steels for engineering and structural purposes. 1915, i. 610.
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- HERSCHKOWITSCH, M., on separation of chromium and manganese. 1920, ii. 398.
- HERSEY, M. L., on microstructure of steel tires. 1911, ii. 640.
- HERTENSUS, J., on Rennerfelt furnace. 1919, ii. 498.
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- HERWIG, W., on estimation of chromium. 1917, ii. 464.
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- HERZFELD, R., on mine drainage. 1913, i. 572.
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- HERZOG, E., on sulphur in the basic converter. 1921, ii. 377.
- HESKETT, JOHN AMBROSE—
Paper on "The utilisation of titaniferous iron ore in New Zealand." 1920, i. 201.
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- HESLOP, W. T., on coal in Natal. 1917, ii. 365.
- HESS, F. L., on Bolivian tungsten deposits. 1921, ii. 335.
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- HESSE, A. W., on methods of working coal. 1914, i. 625; 1915, i. 534.
- HESSE, B. C., on coal-tar dye industry. 1916, ii. 403.
- HETHEY, A.—
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- HEUBACH, on iron ore in Sweden. 1911, ii. 475.
- HEWETT, D. F., on manganese ore in United States. 1914, ii. 404; 1917, i. 284; 1919, ii. 461; 1920, ii. 310.
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- HEWITT, C. T., on tempering of steel. 1920, ii. 372.
- HEWITT, W., on winding-ropes. 1911, i. 570.
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- HEWSON, G. W., on blast-furnace practice. 1920, i. 226.
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- HEWSON, G. W., on hardness tests of coke. 1918, i. 483.
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- HEYCOCK, C. T., on metallic alloys. 1920, ii. 392.
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- HEYM, F., on dry air blast. 1912, i. 498.
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- HEYMANN, G., on steelworks equipment. 1913, i. 624.
- HEYN, E., on action of aqueous solutions of electrolytes on iron. 1911, i. 125.
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- HIBBARD, H. D., on alloy steels. 1915, i. 611.
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- HIBBARD, H. W., on properties of steel castings. 1920, ii. 352.
- HIBBERT, E., on estimation of iron in titaniferous minerals. 1911, ii. 661.
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- HIBBERT, H., on potash recovery from blast-furnace gas. 1920, i. 708.
- HIBBIN, S. G., on lighting of steelworks. 1918, i. 516.
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- HICKLING, H. G. A., on structure of coal. 1914, ii. 288.
- HICKMAN, W., CHRISTIE elected member. 1912, i. 3.

- HIERTZ, E., on agglomeration of flue-dust. 1914, i. 586.
- HIGGINS, E., on prevention of accidents in mines. 1913, ii. 517; 1914, ii. 276.
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- HIGGINS, J. H., on properties of forged bars. 1920, i. 745.
- HIGGINS, W. F., on flow of oil through pipes. 1916, i. 320.
- HIGGINSON, J., on mine surveying. 1913, i. 520.
- HIGHBITER, H. W., on malleable cast iron. 1921, i. 451.
- HIGSON, G. I., on photo-micrography. 1920, i. 757.
- HIKI, T., on meteorites. 1913, i. 518.
- HILGE, K., on alloys of manganese and cobalt. 1914, i. 730.
- HILGENSTOCK, R. W., on recovery of by-products from peat. 1911, i. 548.
- HILL, A., on moulding. 1917, ii. 398.
- HILL, A. M., on use of pulverised coal. 1913, ii. 534.
- HILL, B., on consumption of natural gas in the United States. 1914, i. 766.
- HILL, CYRIL FRANCIS, elected member. 1912, i. 3.
- HILL, D. U., on rate of solution of metals in ferric salts. 1917, i. 422.
- HILL, FRANK, obituary notice of. 1912, ii. 433.
- HILL, HOWARD CLAYTON, elected member. 1920, i. 4.
- HILL, HENRY GEORGE, elected member. 1912, i. 3.
- HILL, H. P., on cleaning blast-furnace gas. 1916, ii. 418.
- HILL, J., on spontaneous combustion of coal. 1917, ii. 386.
- HILL, JOSEPH ALBERT, elected member. 1918, ii. 3.
- HILL, J. M., on iron ore in the United States. 1912, ii. 450.
- HILL, J. NORMAN, elected member. 1913, i. 2.
- HILL, J. R., on passivity of iron. 1912, i. 595.
- HILL, L., on rescue work and appliances. 1911, i. 574.
- HILL, L. G., on stone-dusting in collieries. 1917, ii. 385.
- HILL, PERCY WOLMER, elected member. 1918, i. 3.
- HILL, W., on utilisation of surplus gas. 1919, ii. 481.
- HILLEBRAND, W. F., on analysis of pig iron. 1915, ii. 265.
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- HILLER, E. G., on gas-engines. 1914, i. 620.
- HILLHOUSE, J., on coal in the United States. 1911, i. 546.
- HILLMAN, M. P. G., on blast-furnace practice in United States. 1914, ii. 318.
- HILLMAN, R. R., on annealing of steel castings. 1921, i. 437.
- HILLMAN, V. E., on acid brittleness. 1921, i. 448.
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- HILLS, G., on electric welding. 1913, ii. 643.
- HILLS, M. F., on welding. 1919, ii. 514.
- HILLS, R. C., on coal in Canada. 1915, ii. 234.
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- HILLS, V. G., on economics of iron ore mining. 1915, i. 495.
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- HILPERT, S.—

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- HILPERT, S., on arsenides of iron and manganese. 1912, i. 588, 609.
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- HINDS, H., on coal in Missouri. 1913, i. 542.
- HINMAN, W. H., on the Hinman-Junkers calorimeter. 1915, i. 504.
- HINRICHSSEN, F. W., on analysing of coals. 1913, i. 695.
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- HINTZ, E., on analysis of iron ores. 1914, i. 746
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- HIORTH, A., on electric furnaces of special types. 1911, ii. 588; 1912, i. 542.
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- HIPKINS, W. E., obituary notice of. 1912, i. 411.
- HIPPARD, C. W., on coal storage. 1920, ii. 341.
- HIRSCH, on coal-washing. 1911, i. 577.
- HIRSCH, A.—
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- HIRSCHBERG, C. A., on rock drills. 1915, i. 492.
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- HIRSCHI, A., on mine surveying. 1912, ii. 459.
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- HIRSHBERG, L. K., on origin of coal. 1913, i. 535.
- HIRSHFIELD, C. F., on low-temperature electro-thermal process. 1917, ii. 362.
- HIRST, D. J., obituary notice of. 1915, i. 459.
- HITCH, HENRY BERTRAM, elected member. 1921, i. 3.
- HITZEL, E., on hardening in hot water. 1916, i. 359.
- HIXON, A. W., on chemical properties of certain asphalts. 1917, ii. 372.
- HJORT, VILHELM FREDERIK, elected member. 1914, i. 2.
- HOAG, M. E., on foundry equipment. 1911, i. 598.
 on hardening and annealing of steels. 1911, i. 634.
- HOBART, F., on iron trade statistics of United States. 1911, i. 701; 1914, ii. 405.

- HOBART, H. M., on welding. 1919, i. 691, ii. 514.
 HOBLYN, JOHN BRIGHT, on heat-treatment of motor parts. 1918, ii. 485.
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 HOBSON, ROBERT, elected member. 1921, i. 3.
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 HODGSON, GEORGE HUGH, elected member. 1920, ii. 4.
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 HODGSON, R. M., on coal in Siberia. 1914, i. 599.
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 HOFFMAN, J. L., on determination of cobalt and nickel in cobalt steel. 1921,
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 HOFFMANN, E. J., on analysis of furnace gases. 1912, i. 612.
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 HOFFMANN, F., on analysis of producer-gas. 1916, i. 402.
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 HOFINGHOFF, W., on combustion of coke-oven gas in open-hearth furnaces.
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 HOGBOM, A. G., on meteoric iron. 1914, i. 578.
 HODGEN, R. C., on management of cupola operations. 1915, i. 559.

- Hogg, E. M., on passivity of iron. 1916, i. 396.
- Hogg, J., on pipe-founding. 1915, ii. 271.
- HOHENSEE, on analysis of gas. 1911, ii. 669.
- HOHN, E., on tests of oxy-acetylene and electric welds. 1916, i. 367.
- HÖING, S., on winding-engines. 1912, ii. 512.
- HOISESCO, C., on petroleum in Roumania. 1914, ii. 296.
- HOLBECK, A. A., on sources of heat for forging furnaces. 1916, ii. 436.
- HOLBERRY, F., on castings for rolling-mill parts. 1921, i. 414.
- HOLBROOK, E. A., on dry preparation of coal. 1916, ii. 414.
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- HOLDE, D., on estimation of asphalt in petroleum. 1914, ii. 396.
- HOLDEN, A., on electrodes for steel furnaces. 1919, i. 667.
- HOLDEN, J. A., on economical production of electric steel. 1919, ii. 498.
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- HOLDEN, R. J., on American blast-furnaces. 1912, ii. 527.
- HOLDEN, J., on use of liquid fuel. 1912, i. 476.
- HOLDER, JAMES HENRY, elected member. 1915, i. 2.
- HOLGATE, JOHN EDWARD, elected member. 1920, i. 4.
- HOLGATE, T. E., on carburisation of iron. 1915, ii. 114.
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- HOLICKY, J., on classification of foundry iron by analysis. 1911, ii. 560.
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- HOLIDAY, R., on use of electric power in collieries. 1914, ii. 308.
- HOLLAND, E. B., on calorimetry. 1920, i. 685.
- HOLLAND, J., on the ganister industry in Sheffield. 1918, i. 476.
- HOLLAND, SIR T. H., on coal in India. 1911, i. 543.
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- HOLLANDER, S. G., on hardening of dies. 1911, i. 634.
- HOLLE, W., on analysis of ground basic slag. 1915, i. 634.
- HOLLENDER, on explosion in collieries. 1912, i. 489.
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- HOLLINGS, W. W.—
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- HOLLINGWORTH, D. V., on theory of coking. 1917, ii. 368.

- HOLLINGWORTH, R. V., on coke-oven gas. 1919, i. 641.
- HOLLIS, H., on electric conditions of arc furnaces. 1916, ii. 432.
- HOLLMAN, E., on structure of limey slags. 1919, ii. 489.
- HOLLOWAY, G. T., on valuation of ores and minerals. 1912, ii. 644.
- HOLM, H., on coking of peat. 1919, i. 641.
- HOLMES, ALBERT BADEN, elected associate. 1921, ii. 12.
- HOLMES, A. J., on systematisation of foundry operations. 1914, ii. 335.
- HOLMES, COLIN W. F., elected associate. 1917, i. 5.
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- HOLMES, EDWARD, elected member. 1911, ii. 9.
- HOLMES, J. A., on coal in the United States. 1911, ii. 510.
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- HOLMES, JOHN WILLIAM, elected member. 1916, i. 3.
- HOLMES, T. E., on a new form of electrically-driven rolling-mill. 1913, i. 90.
- HOLMGREN, E. F., on power requirements of rolling-mills. 1920, i. 728.
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- HOLMGREN, G. M., on iron ore in United States. 1915, i. 485.
- HOLROYD, C. J., on electrical equipment of collieries. 1911, ii. 528.
- HOLT, A., on allotropy and metastability of metals. 1915, ii. 321.
- HOLT, F. VON, on heat efficiency of open-hearth furnaces. 1914, ii. 337.
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- HOLT, R. B., on tramway rails. 1911, i. 654; 1912, i. 570.
- HOLZ, O., on character of basic pig iron. 1921, ii. 377.
- HOLZHÜTTER, E., on briquetting of iron ore and flue dust. 1912, i. 451.
- HOLZWARTH, H., on gas-turbines. 1920, ii. 341.
- HOLZWEILER, C., on roll-draughting. 1911, i. 612; 1915, i. 579.
- HOMAN, J. G., on manufacture of steel sheets. 1913, i. 652, ii. 645.
- HOMERBERG, VICTOR OLIVER, elected member. 1920, ii. 4.
- HOMERSHAM, THOMAS HENRY C., on electric refining of steel. 1918, i. 513.
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- HOMFRAY, I. F., on absorption of gases by charcoal. 1911, i. 548.
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on expansion of steel at high temperature. 1918, ii. 499.

on hardness of metals. 1918, i. 536.

on iron cobalt alloys. 1919, ii. 530.

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on magnetic and electric properties of iron and steel. 1913, ii. 677; 1914, ii. 375, 377.

on magnetic investigation of the state of cementite in carbon steels. 1918, i. 552.

on magnetic susceptibility of iron compounds. 1915, i. 617.

on magnetic susceptibility of manganese oxides. 1914, ii. 379.

on magnetisation of iron alloys. 1921, i. 463.

on structural changes of magnet steel due to heat-treatment. 1918, i. 553.

on temperature of the reversible transformation points. 1917, ii. 444.

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on thermal effects and magnetic changes at high temperatures. 1914, i. 713.

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on thermo-magnetic properties of carbides in steels. 1918, i. 552.

on transformations of iron and steel at high temperatures. 1914, i. 719.

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HONDA, K., and T. MURAKAMI—

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HONDA, K., and S. SAITO—

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HOOPER, G. R., on annealing furnaces. 1912, i. 548.

HOOVER, C. R., on atomic weight of carbon. 1915, ii. 333.

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HOOVER, H. C., on history of mining. 1913, i. 522.

on stabilisation of coal industry. 1920, ii. 342.

HOOVER, L. H., on history of mining. 1913, i. 522.

HOPKINS, GEORGE A., elected member. 1919, i. 3.

HOPKINS, O. B., on asbestos deposits of Georgia. 1915, i. 502.

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HOPKINSON, B.—

Paper on "The magnetic and mechanical properties of manganese steel." See HADFIELD, SIR R. A.

on elastic hysteresis of steel. 1913, i. 663.

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HOPKINSON, JOHN ALFRED, elected member. 1916, ii. 1.

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- HOPWOOD, A., on properties of fireclays. 1913, ii. 525.
- HOPWOOD, W., on coal in North Borneo. 1917, i. 312.
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- HORE, R. E., on iron ore in Ontario. 1913, i. 511.
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- HOREL, U., on use of winding-ropes. 1911, ii. 531.
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- HÖRHAGER, J., on magnesite. 1911, ii. 498.
- HORNADAY, W. D., on composition of coal. 1912, i. 462.
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- HORNE, SIR ROBERT, speech at annual dinner by. 1920, i. 658.
- HORNER, J., on bending and welding rolled sections. 1913, ii. 643.
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- HORNER, J. G., on foundry patterns and moulding. 1911, i. 599 ; 1916, i. 341.
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- HORNER, F. W., on concentration of molybdenum ores. 1917, ii. 347.
- HORNER, W. J., on joints in foundry patterns. 1913, ii. 606.
- HORNOR, H. A., on application of electric welding to shipbuilding. 1919, i. 678.
- HORRY, W. S., on electric furnace practice. 1914, ii. 340.
- HORSBURGH, E. M., on fracture of wire in ropes. 1921, ii. 401.
- HORSBURGH, GORDON DONALD LEE, elected member. 1921, ii. 10.
- HORSFIELD, EDWARD BAINES, elected member. 1911, i. 3.
- HORSLEY, SIWARD MYLES, elected member. 1918, i. 3.
- HOET, H., on corrugation of rails. 1913, i. 666.
- HORTON, F. W., on statistics of accidents in mines in United States. 1913, ii. 724 ; 1914, i. 632.
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- HORTON, J., on Baldwins' steelworks. 1921, i. 427.
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- HORVITZ, G. J., on metallography of high-speed steel. 1919, ii. 509.
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- HORWOOD, A. R., on coal in Leicestershire. 1920, i. 692.
- HOSKINS, A. J., on oil-shale of Colorado. 1919, ii. 478.
- HOSKINS, ARTHUR SIDNEY, elected member. 1920, ii. 4.

- HOSKINS, CECIL HAROLD, elected member. 1920, ii. 4.
- HOSKISON, T., on cooling blast-furnace boshes. 1913, i. 580.
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- HOSTETTER, J. C., on artificial and natural oxides of iron. 1918, ii. 430.
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- HOTHERSALL, W. C., on prevention of hardening cracks in tool steel. 1921, i. 224.
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- HOUBEN, J., on determination of iron. 1920, ii. 397.
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- HOW, HENRY EDMUND, elected associate. 1917, i. 5.
- HOWARD, C., on electric control of steel mills. 1920, ii. 367.
- HOWARD, J. E., on endurance of steels. 1921, ii. 398.
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- HOWARD, JOHN WILLIAM, obituary notice of. 1912, ii. 433.
- HOWARTH, G. B., on flue-gas analysis. 1921, i. 473.

HOWARTH, GEORGE EDWIN, elected member. 1914, i. 2.

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on influence of annealing on chemical properties of steel. 1913, i. 647.

on influence of elements on the mechanical properties of steel. 1916, ii. 357.

on influence of heat-treatment on the thermo-electric properties and specific resistance of carbon steels. 1916, ii. 286.

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- HOWE, H. M., on pro-eutectoid cementite. 1912, ii. 382.
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HUESSENER, K., on blast-furnace combustion. 1916, i. 324.

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HULBERT, W. R., on ferro-alloys produced by thermit reactions. 1911, ii. 630.
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HULETT, G. A., on coal distillation under pressure. 1918, i. 483.

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HULLS, CECIL ARTHUR, elected member. 1920, i. 4.

HULST, J., on repair department of a modern steel plant. 1914, ii. 340.

HULT, W. L., on analysis of iron ore. 1920, i. 763.

HULTGREN, A., on structure of tungsten steel. 1921, ii. 139.

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HULTMANN, G. H., on coal-washing. 1911, i. 577.

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HUMBERT, E., on direct production of steel. 1914, ii. 342.

on steel-melting furnaces for foundries. 1914, i. 661.

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HUMBERT, E., and A. HETHEY—

Paper on "The production of steel direct from ore." 1914, i. 378; introduction, 378; three series of tests made with ordinary arc furnace
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HUME, W. F., on geology of petroleum. 1915, i. 519.

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Paper on "Macro-etching and macro-printing." 1919, i. 273; printing, 279; interpretation of the etchings, 280; examples, 282.—*Discussion*: A. McWilliam, 287; W. H. Hatfield, 287; J. H. Whiteley, 288; W. Rosenhain, 289; J. E. Stead, 292; E. H. Saniter, 292; H. H. Ashdown, 293.—*Correspondence*: J. H. S. Dickenson, 294; O. W. Ellis, 295; G. W. Green, 296; N. P. P. Sandberg, 299; E. H. Saniter, 299; J. C. W. Humfrey (reply), 300.

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Paper on "The intercrystalline fracture of iron and steel." **C.S.M.**, 1912, iv. 80; Appendix—apparatus employed in the experimental work, 102.

Paper on "Influence of intercrystalline cohesion upon the mechanical properties of metals." **C.S.M.**, 1913, v. 86.

Paper on "The tenacity, deformation and fracture of soft steel at high temperatures." See ROSENHAIN, W.

on the ball test. 1920, i. 358.

on crystallising properties of electro-deposited iron. 1913, ii. 156.

on hardening of steels. 1914, i. 182, 257, ii. 368; 1915, i. 621.

on intercrystalline cohesion of metals. 1913, ii. 653.

on internal stresses. 1921, i. 459.

on nickel-chrome steels. 1919, ii. 384.

on welding-up of blowholes in ingots. 1921, i. 55.

HUMMEL, E. C., on liquid ferro-manganese in the open-hearth furnace. 1918, ii. 472.

HUMMEL, H. H., on design of blooming-mills. 1918, i. 521.

HUMPERDINCK, on foundry practice in the United States. 1913, i. 606.

HUMPHREY, A. L., on manufacture of shells. 1916, ii. 445.

on organising for munitions manufacture. 1917, ii. 428.

HUMPHREY, H. A., on producer-gas for power and heating. 1913, i. 565.

HUMPHREY, R. L., on strength of reinforced concrete beams. 1914, i. 712.

HUMPHREYS, JAMES HULSE, elected member. 1918, ii. 3.

HUMPHRIES, C. H., on preparation of pure molybdenum. 1917, ii. 457.

HUMPHRIES, R., on construction of and maintenance of rail joints. 1914, ii. 374.

HUNGER, E. A., on labour-saving in foundries. 1921, i. 417.

HUNNINGS, S. V., on new vibratory testing-machine. 1914, ii. 367.

HUNT, C. H., on plant of the Weirton Steel Co. 1921, i. 427, 432.

HUNT, R. W., on history of Bessemer process. 1913, i. 630.

on inspection of steel rails. 1913, i. 666.

on rail rolling-mill practice. 1913, ii. 644; 1914, ii. 347; 1920, i. 745.

on rail specifications. 1916, i. 382; 1921, ii. 407.

on segregation in ladle test ingots. 1916, i. 350.

on soundness in steel rails. 1912, ii. 373; 1915, i. 589.

on United States iron trade. 1911, ii. 555.

HUNTER, A. H., on molybdenum. 1921, i. 375.

on molybdenum steel. 1921, ii. 403.

HUNTER, C. M., on petroleum in Persia. 1920, ii. 333.

HUNTER, M. A., on titanium. 1911, ii. 625.

HUNTER, S., on coal-washing. 1911, i. 576.

HUNTER, T. M., on gas-circulation in hot-blast stoves. 1918, i. 491.

on gas-firing of boilers. 1918, i. 486.

HUNTING, F. F.—

Paper on "Note on the microstructure of commercially pure iron between Ar₃ and Ar₂." See BROOKE, W. J.

elected member. 1917, ii. 3.

HUNTINGTON, A. K., on effect of temperature on tensile strength of metals. 1913, i. 661.

on preparing sections of fractures for microscopical examination. 1913, ii. 389.

on tensile strength of alloys at high temperatures. 1915, ii. 301.

- HUNTINGTON, E. V., on mine surveying. 1915, i. 491.
 on rapid solution of fault problems. 1914, ii. 275.
- HUNTINGTON, W. C., on influence of hot-rolling on properties and structure of low-carbon steel. 1918, i. 523.
- HUNTLEY, E., on wood-gas producer. 1917, i. 328.
- HUNTLEY, G. N., on growth of cast iron. 1911, i. 241.
- HUNTLEY, L. G., on economics of the petroleum industry. 1914, ii. 302.
 on natural-gas in Canada. 1915, ii. 247.
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- HUNTLEY, S., on petroleum in United States. 1920, ii. 334.
- HUNTLY, G. N., on corrections in bomb calorimetry. 1915, i. 504.
- HURE, J., on tungsten ores in France. 1916, ii. 381.
- HURMUZESCU, A., on radio-activity of petroleum. 1911, i. 557.
- HURREN, F. H., on hardness testing. 1911, ii. 621.
 on influence of casting temperature on physical properties of metals. 1917, ii. 397.
 on malleable cast iron. 1921, i. 416.
 on scrap castings. 1921, i. 412.
 elected member. 1918, i. 3.
- HURST, FRANK ARNOLD, elected member. 1917, ii. 3.
- HURST, HORACE WESTMORELAND, elected associate. 1917, i. 5.
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Paper, "Notes on the heat-treatment of grey cast iron." 1917, ii. 121; microstructures, 125; influence of phosphorus, 127.—*Discussion*: H. C. H. Carpenter, 129; E. Adamson, 130; H. J. Young, 132.—*Correspondence*: J. E. Hurst (reply), 134.
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Paper on "An investigation on the wearing and anti-frictional qualities of cast iron." C.S.M., 1918, ix. 59.
Paper on "Improvements in the case-hardening process." 1919, i. See HANSON, D.
 on addition of steel to cast iron. 1918, ii. 467.
 on casting in permanent moulds. 1919, ii. 493.
 on cast iron for engine cylinders. 1917, i. 393.
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 on deterioration of grey cast iron due to heating and cooling. 1918, i. 535.
 on influence of elements on cast iron. 1921, ii. 396.
 on influence of heat-treatment on grey cast iron. 1919, ii. 516.
 on influence of free carbon on properties of cast iron. 1915, ii. 318.
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 on surface appearance of molten cast iron. 1916, i. 339.
 on wearing qualities of cast iron, 1918, ii. 492.
 elected member. 1916, ii. 1.
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- HURTER, C. S., on explosives and blasting. 1911, i. 526.
- HURTZIG, ARTHUR CAMERON, obituary notice of. 1915, i. 460.
- HÜSER, F., on reactions in the cupola. 1913, i. 606.
- HUSTLER, WILLIAM HUSTLER, elected member. 1912, ii. 6.
- HUSTON, CHARLES LUKENS, elected member. 1920, i. 4.
- HUSTON, H. A., on potash industry of the United States. 1917, i. 344.
- HUTCHIN, H. W., on estimation of tungsten. 1911, ii. 665.
 on manufacture of ferro-tungsten. 1917, ii. 348.
 on metallurgy of tungsten. 1917, ii. 348.
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- HUTCHINS, O., on pyrometer protection tubes. 1920, i. 687.
- HUTCHINSON, A.—
 Report on "Fuel economy and consumptions in the manufacture of iron and steel. See BONE, W. A.
 on blast-furnace gases. 1921, ii. 364.
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 on direct current compared with three-phase current for driving steel-works plant. 1920, i. 257.
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 on production of sound steel by compression of the ingot. 1918, i. 235.
 on use of pulverised coal. 1919, i. 125.
 on open-hearth practice. 1917, ii. 284.
- HUTCHINSON, A., and E. BURY—
 Paper on "Rough-cleaning of blast-furnace gas at Skinningrove by the Lodge electrostatic process." 1920, ii. 65; preface, 65; historical, 66; general considerations, 68; lay-out and construction, 70; construction, 73; extraction of potash from deposited flue-dust, 75; summary, 81.—*Discussion*: A. Hutchinson, 83; J. E. Stead, 83; H. Louis, 83; A. K. Reese, 84; H. M. Ridge, 84; J. S. Hollings, 85; W. Rosenhain, 86; F. W. Harbord, 86; F. D. Wild, 86; J. E. Stead, 86; A. Hutchinson (reply), 87.—*Correspondence*: W. Stead, 89.
- HUTCHINSON, B. EDWIN, elected member. 1913, i. 3.
- HUTCHINSON, FRED ROLAND, elected member. 1919, i. 3.
- HUTCHINSON, G. H., on coal-handling apparatus. 1914, ii. 314.
- HUTCHINSON, J. W., on gases in mines. 1912, ii. 514.
- HUTCHINSON, R. W., JUN., on methods of working in collieries. 1911, ii. 530.
- HUTCHINSON, T. C.—
 Paper on "Fueleconomy in blast-furnaces." 1918, i. 127; life of certain furnace linings, 127; cleaning ironstone, 128; consumption of ironstone in furnace, 129; analyses of pig iron produced, 130; details and results of experiments with model furnace, 131; analyses of slags in 1901–17, 137; conclusions, 139.—*Discussion*: J. E. Stead, 200; W. Hawdon, 201; D. Sillars, 204; J. H. Harrison, 205; J. S. Hollings, 206.—*Correspondence*: G. H. Gibbs, 212; T. C. Hutchinson (reply), 217.
 on economy of dry blast. 1913, i. 135.
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 on open-hearth processes. 1914, i. 87.

- HUTCHINSON, T. C., on steam-engines for rolling-mills. 1912, i. 354.
 on the Talbot furnace. 1913, ii. 240.
 on utilisation of blast-furnace and coke-oven gases. 1913, ii. 109.
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 obituary notice of. 1919, ii. 454.
- HUTH, A., on use of vertical channels for slag removal. 1913, i. 646.
- HUTTER, C., on analysis of chrome iron ore. 1920, ii. 397.
 on chromite in North Macedonia. 1921, i. 373.
- HUTTON, F. R., on purchase of fuel by analysis. 1912, ii. 476.
- HUXLEY, ARCHIBALD SAMUEL, elected member. 1918, i. 3.
- HUYBRECHTS, M., on estimation of manganese. 1913, ii. 702.
- HYDE, E. P., on measurement of colour temperatures. 1920, i. 687.
- HYDE, J. R., on compressed air in the foundry. 1917, ii. 402.
- HYSLOP, G. P., on coal-dust experiments. 1911, i. 572.

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- IBBOTSON, E. C., on electric furnaces. 1912, i. 87
 on electro-magnets for handling material. 1912, i. 551.
- IBBOTSON, F.—
Paper on "Molecular constitutions of high-speed tool steels and their correlations with lathe efficiencies." See ARNOLD, J. O.
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- IDE, MATAZO, elected member. 1917, ii. 3.
- IDEI, S.—
Paper on "The cause of quenching cracks." See HONDA, K.
 on hardness of carbon steels. 1921, i. 453.
- IFFT, G. N., on graphite. 1911, i. 535.
 on slag cement. 1912, ii. 537.
- IFKOWITSCH, N., on foundry patterns and moulding. 1911, i. 599.
- IKI, T., on petroleum in Japan. 1911, ii. 514.
- ILJIN, N., on the iron-carbon system. 1911, i. 665.
- ILLIES, H., on American steelworks. 1915, i. 575.
 on continuous rolling-mills. 1917, ii. 416.
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 on heating furnaces. 1921, ii. 386.
- ILLINGWORTH, C. B., on estimation of tantalum. 1917, ii. 465.
 on estimation of uranium. 1919, i. 701.
- ILLINGWORTH, S. R., on analysis of coal. 1921, i. 473, ii. 421.
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- ILLMER, L., on failure of crank shafts. 1916, i. 374.
- ILSLEY, L. C., on ignition of mine gases by incandescent lamps. 1913, ii. 570.
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- ILYINE, N. G., on formation of structurally free cementite in mild steel. 1918, i. 549.
- IMHOFF, W. G., on blast-furnace operations. 1915, ii. 258; 1917, i. 338.
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- IMHOFF, W. G., on classification of pig iron. 1917, i. 345.
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- IMRIE, JOHN, elected member. 1918, i. 3.
- INCHLEY, W., on pyrometry. 1911, ii. 502.
- INDENKEMPEN, E., on furnaces for melting ferro-manganese. 1914, ii. 338.
- INGALL, DOUGLAS HEBER, elected member. 1921, i. 3.
- INGERSOLL, L. R., on physical properties of nickel iron alloys. 1921, i. 463.
- INGLEBY, JOSEPH, obituary notice of. 1916, ii. 363.
- INGLE-FINCH, GEORGE, elected member. 1913, ii. 4.
- INNES, J., on history of petroleum. 1914, ii. 303.
 on measurement of hardness. 1921, i. 453.
- INOSTANZEFF, A. A., on native iron ore. 1912, i. 440.
- INOUE, K., on estimation of carbide carbon in iron. 1920, ii. 396.
- INOUE, TAIICHI, elected member. 1911, ii. 10.
- INSLEY, H., on constitution of silica bricks. 1919, ii. 466.
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- IOKIBE, K., on the crystalline nature of graphite. 1921, i. 450.
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- IONIDES, A. C., on gas-fired metallurgical furnaces. 1917, ii. 413.
- IPATIEV, W., on origin of petroleum. 1912, i. 473 ; 1912, ii. 494.
- IREDALE, THOMAS, obituary notice of. 1914, i. 554.
- IRINYI, A., on substitutes for oil fuel. 1915, i. 525.
- IRION, E., on testing machines. 1920, ii. 380 ; 1921, ii. 397.
- IRMANN, R., on acid-resisting iron. 1918, i. 545.
- IRONS, R. H., on bottom plates for pouring ingots. 1916, i. 349.
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- IRONSIDE, EDWARD ALLAN, elected member. 1920, ii. 4.
- IRRESBERGER, C., on casting machine. 1918, i. 508.
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- IRRESBERGER, C., on the Grönwall-Dixon electric furnace. 1918, i. 515.
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- IRWIN, CHARLES ARMSTRONG, elected member. 1919, i. 4.
- ISAAC, A. E., elected associate. 1921, i. 6.
- ISAAC, SIDNEY RUSSELL, elected member. 1919, i. 4.
- ISHAM, H., on estimation of carbon. 1911, ii. 656.
- ISHAM, R. M., on estimation of titanium. 1911, i. 687.
- ISHEWSKY, W. P., on production of granular pearlite in steel. 1915, i. 585.
- ISHIKAWA, FUKUSABURO, elected member. 1915, i. 2.
- ITAKA, I., on determination of cementite transformation. 1919, ii. 533.
- ISHIWARA, T., on determination of transformation points by magnetic means. 1918, i. 551.
 on magnetic analysis of carbides in steel. 1918, ii. 505.
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- IVANOFF, P., on prevention of piping in ingots. 1912, ii. 563; 1913, ii. 626.
- IVES, L. E., on electric shovels in iron ore mining. 1915, i. 492.
 on iron ore in Michigan. 1915, i. 485.
- IWASAKI, C., on Japanese coal. 1920, ii. 326.
- IZART, J., on utilisation of low grade fuel. 1911, ii. 504.
- IZAT, ANDREW, elected member. 1912, i. 3.
- IZGARYSCHEER, N. A., on passivity of iron. 1916, i. 397.
- IZOD, G., on rock drills. 1914, i. 580.

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- JABOULAY, E., on determination of sulphur. 1911, ii. 657.
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- JACK, H. S. M., on petroleum in India. 1917, ii. 373.
- JACKSON, C. F., on electricity in mines. 1911, i. 566.
- JACKSON, E. W., on blast-furnace practice. 1920, i. 220.
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- JACKSON, SIR HENRY MATHER, BART., elected member. 1920, ii. 4.
- JACKSON, H. S., on cleaning of blast-furnace gases. 1913, i. 585.
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- JACKSON, JOHN, elected member. 1917, ii. 3.
- JACKSON, JOHN, elected member. 1920, i. 4.
- JACKSON, JOHN ARTHUR, elected member. 1911, i. 3.
- JACKSON, L., on welding processes. 1919, i. 676.
- JACKSON, LEONARD, elected member. 1913, i. 3.
- JACKSON, SIDNEY REED, elected associate. 1918, i. 7.
- JACKSON, STANLEY ARTHUR, elected associate. 1919, i. 6.
 transferred to membership. 1921, i. 6.
- JACKSON, STEPHEN HART, JUN., elected member. 1914, i. 3.
- JACKSON, WILLIAM UPRICHARD, elected member. 1913, i. 3.
- JACOBI, W. H., on pulverised coal. 1920, i. 689.
- JACOBS, E., on coal in British Columbia. 1911, ii. 509.
 on coal in Canada. 1912, ii. 484.

- JACOBS, E., on statistics of coal-mining in British Columbia. 1914, ii. 399.
- JACOBS, F. B., on forging of axes. 1921, ii. 380.
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- JACOBS, H. W., on autogenous welding. 1912, i. 552
- JACOBS, W. A., on analysis of liquid fuel, 1913, i. 696.
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- JACOBSON, J., on use of scrap-iron briquettes. 1911, i. 594.
- JACOBUS, D. S., on waste-heat boilers. 1920, i. 722.
- JACQUELIN, A., on coal-cutting machinery. 1912, ii. 510.
- JAEGGER, on search for coal in Upper Silesia. 1911, ii. 506.
- JAGSCH, E., on history of iron. 1912, i. 509.
- JAMES, G. D., on petroleum in Utah. 1912, i. 475.
- JAMES, G. M., on melting of aluminium scrap. 1917, i. 357.
- JAMES, H. D., on equipment of blast-furnaces. 1917, ii. 392.
- JAMES, H. G., on the oil-refining industry of the United States. 1917, i. 322.
- JAMES, H. L., on roll design. 1914, i. 686.
- JAMES, R., on pulverised coal. 1921, ii. 346.
- JAMESON, A. H., on steel foundry practice. 1911, i. 596.
- JAMIESON, E. A., elected member. 1918, i. 4.
- JAMIESON, G. S., on estimation of molybdenum. 1917, ii. 468.
on estimation of titanium. 1914, i. 748.
- JAMISON, C. E., on petroleum in the United States. 1911, ii. 516; 1912, ii. 498; 1913, i. 556.
- JÄNECKE, E., on allotropic transformation of nickel. 1919, ii. 532.
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- JANITZKY, E. J., on heat treatment. 1921, ii. 390.
- JANNERET, B., on action of phosphoric acid on alloys. 1911, ii. 648.
- JANSEN, on packing and transport of explosives. 1913, ii. 566.
- JANSSEN, W. A., on design of regenerators. 1915, ii. 278.
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- JANSSEN, W. R., on use of oil fuel. 1918, i. 500, ii. 457.
- JANTZEN, E., on briquetting ore and flue dust in America. 1914, ii. 279.
- JANUS, F., on investigations of metals by means of X-rays. 1918, ii. 500.
- JAQUES, ARCHIBALD VALENTINE, elected member. 1920, ii. 4.
- JARVIS, R. P., on iron ore in Tennessee. 1913, i. 515.
- JARVIS, S. E., elected associate. 1917, i. 5.
- JASPER, DONALD MALCOLM, elected member. 1921, i. 3.
- JASSONEIX, B. DU, on magnetic permeability of iron alloys. 1913, ii. 678.
- JAYARUM, B., on manganese ore in India. 1919, ii. 460.
- JAYNE, JAMES HENRY, elected member. 1919, i. 4.
- JAYNE, W. E., on machine-mining practice in South Wales. 1914, i. 624.
- JEANS, JAMES STEPHEN, obituary notice of. 1913, ii. 479.
- JEFFERY, A. T., on machining of malleable castings. 1918, i. 503.
- JEFFRIES, Z., on atoms and metals. 1921, i. 466.

- JEFFRIES, Z., on crystalline structure of metals. 1921, ii. 412.
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 on measuring areas of alloys constituents. 1914, i. 716.
 on melting points of tungsten and molybdenum. 1916, ii. 461.
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- JENKINS, A. L., on tests on cast-iron press frames. 1911, i. 645.
- JENKINS, A. T., on welds. 1911, i. 119.
- JENKINS, E. J., on a new magnesium alloy. 1920, ii. 392.
- JENKINS, IVOR O., elected member. 1912, i. 3.
- JENKINS, JOHN, elected member. 1916, i. 3.
- JENKINS, JOHN GWILL, elected associate. 1918, i. 7.
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- JENKINS, J. J., on graphite. 1911, i. 535.
- JENKINS, Sir J. J. *See* GLANTAWE, LORD.
- JENKINS, W. C., on meteorites. 1915, ii. 221.
- JENKINSON, S. H., on design of laminated springs. 1920, ii. 373.
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- JENKNER, E., on by-product recovery. 1912, ii. 491.
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- JENNINGS, E. P., on titaniferous iron ore in the United States. 1913, i. 515.
- JENNINGS, J. T., on lighting of collieries. 1911, ii. 535.
- JENNINGS, MARK, elected associate. 1917, ii. 5.
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- JENNINGS, R. C., on drop forging practice. 1919, ii. 506.
- JENNINGS, ROBERT EUGENE, elected member. 1911, ii. 9.
- JENSEN, E. C., on making large castings. 1914, i. 662.
- JENSEN, HARALD, elected member. 1919, ii. 3.
- JENSEN, H. I., on manganese ore in Queensland. 1919, ii. 461.
- JEPPSON, G. N., on abrasives for special steels. 1911, ii. 605.
- JERMAIN, WILLIAM MORGAN, elected member. 1919, i. 4.
- JESSE, R. H., JUN., on tests on a new calorimeter bomb. 1912, ii. 472.
- JESSUP, D. W., on equipment of iron ore mines. 1913, i. 521.
- JEWELL, G. B., on manufacture of artillery. 1915, ii. 297.
- JEWELL, WILLIAM RALPH, elected member. 1919, i. 4.
- JICŇNSKÝ, on coal-dust experiments. 1912, ii. 515; 1914, i. 630.
- JILLSON, W. R., on low sulphur coals. 1920, i. 691.
- JIMENEZ, C. P., on mineral industry of Peru. 1921, ii. 336.
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- KAFKA, E., on separation of tungsten and molybdenum. 1912, ii. 624.
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- KENDALL, P. F., on clays of Northern Yorkshire. 1917, i. 300.
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- KENDALL, RICHARD, elected member. 1912, ii. 6.
- KENDRICK, H., on storage and spontaneous combustion of coal. 1913, i. 576.
- KENDRICK, JOSEPH, elected member. 1915, i. 2.
- KENDRICK, R. M., on iron ores of the Forest of Dean. 1917, ii. 345.
- KENNEDY, D. F., on manufacture of springs. 1921, i. 446.
- KENNEDY, H. J., on use of oil fuel. 1918, ii. 457.
- KENNEDY, LUMLEY, elected member. 1921, ii. 10.
- KENNEDY, ROBERT, elected member. 1917, ii. 3.
- KENNEDY, R. E., on core-making. 1918, i. 507.
- KENNEDY, R. S., on electric welding. 1919, i. 677.
- KENNEDY, W. C., on controlling mill screwdowns. 1920, ii. 367.
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- KENNELLY, A. E., on electric resistance of steel rails. 1916, ii. 458.
- KENNEY, E. F., on production of sound ingots. 1915, ii. 235.
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- KENNEY, L. H., on specifications of tool steel. 1913, i. 667.
- KENRICK, JOHN PAINTER, elected member. 1912, i. 3.
- KENT, H. A., on occlusion of gases in metals. 1919, i. 689.
- KENT, W., on composition of coals. 1914, ii. 286.
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- KENTNOWSKI, L., on annealing furnaces. 1912, i. 548.
- KENYON, O. A., on welding. 1914, ii. 359; 1920, i. 737, ii. 376.
- KERN, on magnesite. 1912, i. 456.
- KERN, E. F., on reduction of manganiferous silicate slags. 1920, i. 718.
- KERN, S., on influence of steel additions in the cupola. 1915, i. 560.
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- KERR, E. W., on use of liquid fuel. 1912, i. 477.
- KERR, G. L., on methods of working in collieries. 1911, i. 566.
- KERR, HORACE, elected member. 1916, i. 3.
- KERR, J., JUN., on developments in wrought-iron industry. 1914, i. 652.
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- KERR, J. A., on application of electrical plant in collieries. 1914, i. 623.
- KERR, JAMES SINCLAIR, elected member. 1911, ii. 10.
- KERR, R. B., on hardening of die-blocks. 1921, ii. 391.
- KERSHAW, J. B. C., on coke as boiler fuel. 1917, i. 319.
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- KERSTEN, J.**, on signalling in mines. 1914, i. 633.
- KERSTEN, P.**, on blast-furnace coke. 1921, ii. 350.
- KESSNER, A.**—
Paper on "The development of the drill test as a means of ascertaining the machining properties of iron and other metals, and for the investigation of tool steels." **C.S.M.**, 1913, v. 10.
 on machining qualities of metals. 1920, i. 747.
 awarded Carnegie Research Grant. 1912, i. 27.
 biographical notice of. 1912, i. 28.
- KESTNER, PAUL**, elected member. 1915, ii. 2.
- KETTENBACH, K.**, on influence of carbon and silicon on cast iron. 1914, i. 720.
- KEWLEY, J.**, on the crude oils of Borneo. 1921, ii. 355.
- KEYES, C. R.**, on history of coal mining. 1912, ii. 517.
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- KHARITCHKOFF, K.**, on composition of natural gas. 1914, ii. 303.
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- KICHLINE, F. O.**, on estimation of carbon. 1912, ii. 618.
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- KIDO, K.**, on magnetisation of iron alloys. 1921, i. 463.
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- KIEFER, HERMAN GUY**, elected member. 1912, i. 3.
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- KIESSELBACH, C.**, on drive for sheet-iron rolling-mills. 1914, ii. 346.
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- KIKKAWA, H.**—
Paper on "The effect of chromium and tungsten upon the hardening and tempering of high-speed tool steel. *See* EDWARDS, C. A.
 elected member. 1915, i. 2.
- KILBOURN, G. C.**, on hardening-furnaces. 1911, i. 632.
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- KIMBER, H. C., on speeding up metallurgical analyses. 1919, i. 701.
- KINDELAN, V., on iron ore in Cuba. 1912, i. 440.
- KINDER, H., on deposition of carbon in blast-furnace walls. 1912, i. 496.
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- KINDL, F. H., on rolling-mill practice in United States. 1913, ii. 636.
- KING, A. S., on electric furnace spectrum of iron. 1913, ii. 696.
- KING, C., on electric equipment of collieries. 1913, i. 570.
- KING, C. A., on composition of blast-furnace slag. 1911, i. 590.
- KING, C. R., on coal in South Russia. 1915, i. 507.
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- KING, F. W., on oxy-acetylene welding. 1915, ii. 297.
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- KING, J. T., on concentrating molybdenum ores. 1918, i. 473.
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- KINGSBURY, ARTHUR HOWARD, elected member. 1919, ii. 3.
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- KINLOCH, ROYDEN ISLAY HAMILTON, elected member. 1921, ii. 10.
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- KINSEY, A. S., on cutting gas. 1920, i. 737.
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- KIPGEN, ARTHUR, elected member. 1921, i. 3.
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- KIPPE, O., on manufacture of ore and flue-dust briquettes. 1914, ii. 279.
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- KIRKPATRICK, W. D., on use of liquid fuel. 1913, i. 558.
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- KIRPACH, N., on determination of slag in steel. 1921, i. 430.
- KIRSCH, B., on welds. 1911, i. 104.

- KIRSCHBRAUN, J., on supply and preparation of asphalts. 1912, ii. 500.
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- KITSON, FREDERICK CHARLES, elected member. 1913, ii. 4.
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- KITTL, E., on magnesite in Austria. 1920, ii. 315.
- KIVLEN, J. P. C., on electrical machinery for mines. 1914, i. 624.
- KJELLBERG, O., on welding and cutting. 1920, i. 737.
- KJELLIN, F. A., on reactions in the blast-furnace. 1912, ii. 521.
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- KLAGES, G. W., on steel-lettering stamps. 1917, i. 391.
- KLEIN, A. A., on constitution of silica bricks. 1919, ii. 466.
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- KLEIN, J., on methods of testing plates. 1914, i. 704.
- KLEIN, M., on tests of boiler plate. 1921, ii. 407.
- KLEINE, A., on estimation of arsenic in iron and steel. 1915, i. 630.
- KLESPPER, R., on position of fourth recalescence point in pure iron. 1914, ii. 379.
- KLINE, A. H., on determination of grain-size in metals. 1916, i. 387.
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- KLINGENBERG, G., on by-product gas-producers. 1918, i. 486.
- KLIVER, H., on signals in mines. 1914, i. 633.
- KLIVER, P., on lighting of collieries. 1911, i. 574.
- KLOCKMANN, F., on iron ore in Morocco. 1913, ii. 501.
- KLOSTERMANN, R., on the Blezinger gas-producer. 1915, i. 528.
- KLUGH, B. G., on Dwight and Lloyd process of sintering. 1912, i. 451.
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- KLUYTMANS, C., on case-hardening. 1921, ii. 386.
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- KNAFF, A., on German blast-furnaces. 1911, ii. 546.
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- KNAPP, A., on drilling of oil-wells. 1920, ii. 337.
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- KNAPP, I. N., on bitumen. 1913, i. 560.
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- KNAPP, J. H., on an American steel foundry. 1914, ii. 334.
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- KNAPPICH, J., on welding. 1914, i. 697.
- KNAUDT, O., obituary notice of. 1911, ii. 455.
- KNECHT, E., on estimation of iron in titaniferous minerals. 1911, ii. 661.
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- KNEEBONE, T. H., on methods of mining iron ore. 1911, i. 527.
- KNEELAND, F. H., on power supply in mines. 1914, i. 624.
- KNEPPER, on petroleum in Germany. 1911, ii. 513.
- KNERR, H. C., on alloy sheet steel. 1921, ii. 405.
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- KNESCHE, J. A., on electric smelting of iron ore. 1911, i. 587.
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- KNIGHT, C. W., on nickel ore. 1917, ii. 342.
- KNIGHT, H., on use of coal-cutting machines. 1913, i. 571.
- KNIGHT, HARRY RICHARD, elected member. 1920, i. 4.
- KNIGHT, O. A., on defective forgings. 1919, ii. 506.
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- KNIGHT, R. S. G.—
Paper on "The heat balance of a blast-furnace stove." C.S.M., 1916, vii. 83.
Paper: "Preliminary Report on heat balance of steel furnaces." C.S.M., 1916, vii. 100.
awarded Carnegie Research Grant. 1914, i. 24.
- KNIGHT, S. S., on metallographical appliances. 1911, i. 661.
on steel foundry practice. 1914, i. 661.
- KNIGHT, W., on electric driving of rolling-mills. 1917, i. 375.
- KNIGHT, WILLIAM SHERWIN, elected member. 1921, ii. 10.
- KNIPPING, A., on estimation of sulphur. 1921, i. 471.
- KNOEPEL, C. E., on foundry costs. 1911, i. 606.
- KNOFF, A., on iron ore in the United States. 1911, i. 519.
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- KNOTE, J. M., on concentration of iron ore by roasting. 1912, i. 452.
- KNOWLES, F. K.—
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- KNOWLES, H. B., on estimation of zirconium. 1920, i. 763, ii. 397, 398.
- KNOWLTON, A. A., on magnetic properties of nickel steels and meteoric iron. 1911, i. 408.
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- KNOWLTON, H. B., on case-hardening compounds. 1921, ii. 386.
- KNOX, G., on coal-washing. 1919, i. 645.
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- KNOX, GEORGE ERNEST, elected member. 1920, ii. 4.

- KNOX, H. G., on nomenclature of electric welding. 1919, i. 679.
- KNOX, J. D., on iron-making in Southern Ohio. 1921, i. 408.
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- KNUBLAUCH, on analysis of coal. 1916, i. 402.
- KNUPERT, K., on repair of ports of open-hearth furnaces. 1916, i. 346.
- KOBAYASHI, SHIRO, elected member. 1914, ii. xix.
- KOBÉ, W. H., on petroleum recovery from unconsolidated sands. 1917, i. 323.
- KOBLER, J. F., on physical characteristics of refractories. 1920, i. 681.
- KÖBRICH, C., on iron ore in Germany. 1914, i. 570.
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- KOCH, C. S., on steel foundry practice. 1914, i. 661.
- KOCH, EMIL, elected member. 1911, ii. 10.
- KOCH, H., on passivity of iron. 1912, ii. 614; 1915, i. 628.
- KOCH, P., on estimation of chromium. 1917, ii. 464.
- KOCKUM, F. H., obituary notice of. 1911, ii. 455.
- KOEHLER, W. A., on physical characteristics of refractories. 1921, ii. 342.
- KOENIGS, E., on transportation of small coal. 1914, ii. 314.
- KOEPPING, E. D., on analysis of nickel-chromium alloys. 1917, i. 422.
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- KOERNER, W. E., on electrolytic behaviour of tungsten. 1917, i. 416.
- KOERT, on natural gas in Germany. 1911, i. 558.
- KOHL, E., on petroleum in Lower Alsace. 1921, i. 391.
- KOHLER, F., on mine surveying. 1912, ii. 459.
- KOHLER, G. M., on analysis of flue-gas. 1915, i. 636.
- KÖHLMAN, on iron ores of Lorraine. 1911, i. 516; 1912, i. 621.
- KOHOUT, J. F., on estimation of carbon. 1912, ii. 618.
- KOLLE, H. W., on utilisation of waste heat from open-hearth furnaces. 1918, ii. 343.
- KOLTHOFF, I. M., on estimation of iron. 1921, i. 472.
- KOMMERS, J. B., on effect of cold working on fatigue. 1919, ii. 519.
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- KÖNIG, H., on estimation of cobalt and uranium in steel. 1914, i. 743.
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- KÖNIG, R., on prevention of outbreaks in blast-furnaces. 1913, ii. 579.
- KONSHIN, A. M., on petroleum in Russia. 1914, ii. 296.
- KONSTANIKOW, on iron-antimony alloys. 1911, ii. 624.
- KONSTANTINON, N., on the iron-phosphorus system. 1911, i. 666.
- KOON, S. G., on labour in the steel industry of United States. 1912, ii. 562.
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- KOPPERS, H., on coke manufacture. 1921, ii. 351.
- KORTEN, F., on coal-handling. 1914, i. 635.
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- KORTEN, R., on melting ferro-manganese in the electric furnace. 1912, i. 541.
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- KOTHNY, E., on forging tests of nickel-chrome steel. 1921, i. 441.
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- KOUCHARJEVSKY, S. L., elected member. 1918, i. 4.
- KOUWENHOVEN, W. B., on flaws in rifle-barrel steel. 1920, i. 752.
- KOVSHAROVA, T. V., on volumetric determination of aluminium. 1915, ii. 329.
- KOWALKE, O. L., on acid-resisting iron-silicon alloys. 1917, ii. 434; 1918, i. 545.
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- KOWOLIK, G., on the Becker Steelworks, Germany. 1912, ii. 556.
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- KRAMM, H. E., on manganese in Nova Scotia. 1912, ii. 456.
- KRANAFELDT, P., on electro-magnetic ore concentration. 1914, i. 584.
- KRANZ, W. G., on electrically heated soaking pits. 1919, ii. 501.
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- KRAUS, E. C., on determination of phosphorus in high-speed steels. 1917, i. 421.
- KRAUSE, H., on colouring of metals. 1913, ii. 694.
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- KREMANN, R., on electrolytic deposition of iron. 1918, i. 547, ii. 505.
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- KRESSMANN, F. W., on storage and heating of coal. 1911, ii. 537.
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- KRIEGER, R., on design of steel castings. 1918, ii. 468.
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- KRÖHNKE, O., on graphitisation of cast iron, 1911, i. 673.
- KROLL, V. A.—
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- KRUSE, H., on cast iron monuments. 1917, ii. 401.
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- KUCZYNSKI, T., on estimation of tungsten. 1912, i. 606.
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- KUDLICH, R. H., on gasoline locomotive for mine haulage. 1916, i. 325.
- KÜHL, H., on slag cement. 1913, i. 599.
- KUHLBERG, ALPHONS, elected member. 1911, ii. 10.
- KUHLMANN, A. M., on determination of heat in electric furnaces. 1921, i. 423.
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- KUHN, H. A., on coal resources of Western Pennsylvania. 1915, i. 510.
- KUHN, O. R., on manganese supply. 1921, ii. 337.
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- KUKUK, P., on coal in Germany. 1912, i. 463; 1921, i. 383.
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- KUNZE, W., on automatic control of electrodes. 1918, i. 516.
 on an electric steel melting plant at Sosnowice. 1914, i. 680.
 on utility of modern electric furnaces. 1912, ii. 561; 1913, i. 628.
- KÜPPERS, A., on blast-furnace charging hoist. 1919, i. 650.
- KÜPPERS, E., on appliances for testing air in mines. 1914, i. 631.
- KUREK, F., on case-hardening. 1913, i. 644.
- KURNAKOFF, N. S., on poisonous gases from ferro-silicon. 1917, i. 416.
 on iron-antimony alloys. 1911, ii. 624.
- KURREIN, M., on a testing machine for tension and compression. 1913, i. 656.
- KURTENACKER, A., on estimation of chromium. 1913, ii. 707.
- KUSS, H., on sanitation in collieries. 1912, i. 490.
- KUTZBACH, K., on rolling-mill engines and motors. 1912, ii. 571.
- KUZELL, C. R., on use of coal-dust in reverberatory furnaces. 1916, i. 307.

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- LABROUSSE, CH. JACQUES, elected member. 1914, i. 3.
- LACEY, JAMES, elected member. 1920, i. 4.
- LACHER, G. L., on blast-furnace at Gary. 1920, ii. 348.
 on coking plant at Wisconsin steelworks. 1920, ii. 330.
 on cupola charging. 1921, i. 412.
 on duplex plant. 1920, ii. 356.
 on heat-treatment furnaces. 1921, ii. 387.
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 on rolling-mills of Scullin Steel Co. 1921, i. 431.
- LACHMUND, O., sampling of ores. 1911, i. 685.
- LACROIX, on ventilation of collieries. 1912, i. 488.
- LA CROIX, M. F., on the iron industries of Lorraine, Saar District, Luxemburg and Belgium. 1921, i. 406.
- LACY, EDWIN, elected member. 1916, i. 3.
- LAIDLER, G., on core-room practice. 1913, ii. 607.
- LAIRD, K. V., on electrical cleaning of blast-furnace gas. 1920, i. 707.
- LAIRD, R. A., on magnesite industry of Washington. 1920, ii. 315.
- LAISTER, C. B., on atomic metallurgy. 1920, i. 758.
- LAKE, E. F., on air-hardened versus case-hardened steel parts. 1918, i. 525.
 on American laboratories and apparatus. 1913, ii. 707.
 on autogenous welding. 1911, i. 639.
 on carburisation of steel by gases. 1912, ii. 553.
 on casting in a vacuum. 1912, ii. 547.
 on determination of transformation points of steel. 1915, ii. 320.
 on die-casting machines. 1911, ii. 569.
 on foundry of Brayonne Steel Casting Co., 1911, ii. 572.
 on gas and oil-fired reheating furnaces. 1914, ii. 345.
 on hardening furnaces. 1911, i. 682; ii. 596.
 on heat-treatment of steel. 1913, ii. 641; 1915, ii. 295.
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 on manufacture of electric steel castings. 1913, ii. 603.
 on manufacture of springs. 1913, ii. 646.
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- LAKE, E. F., on use of titanium in steel making. 1913, ii. 627.
- LAKE, WILLIAM BEARD, elected member. 1918, i. 4.
- LAKE, W. H., on electric driving of rolling-mills. 1912, i. 528.
- LAKES, A., on Canadian oil-shales. 1912, ii. 497.
 on coal in the United States. 1911, i. 546.
 on coal-fields of Western Canada. 1913, ii. 541.
 on geology of coal. 1911, i. 541.
 on origin of petroleum. 1911, i. 553, ii. 513.
- LAKES, H., on timbering in iron ore mines. 1912, i. 444.
- LALAING, THE COMTE DE, speech at Dinner by. 1914, i. 548.
- LAMBERT, ARTHUR GEORGE, elected associate. 1917, i. 6.
- LAMBERT, B., on corrosion of iron. 1911, i. 674; 1912, ii. 609.
 on electrolytic corrosion. 1913, i. 685; 1914, i. 736.
 on passivity. 1915, i. 627.
- LAMBERT, J., on steel foundry practice. 1913, ii. 600.
- LAMBERT, R., on calorific values of coals. 1914, i. 591.
- LAMBERTON, A.—
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 on steam-engines for rolling-mills. 1912, i. 351.
 elected Vice-President. 1915, i. 14.
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- LAMBERTON, JOHN ROBERTSON, elected member. 1920, ii. 4.
- LAMBOT, J., on steel-melting furnaces for foundries. 1914, i. 661.
- LAMBOTTE, C., on manufacture of coal briquettes. 1915, i. 540.
- LAMLA, M., on malleable cast iron. 1911, i. 605, ii. 571.
- LAMM, ARNOLD URE, elected member. 1920, i. 4.
- LÄMMERT, on methods of mining iron ore. 1911, i. 527.
- LAMONT, R. P., on steel foundry practice. 1918, i. 504.
- LAMOUREUX, Y., on foundry practice. 1912, ii. 547; 1913, i. 616.
- LAMPLOUGH, F. E. E., on use of pulverised coal as fuel. 1913, ii. 534.
- LANDAU, M., on preservation of mine timber. 1913, i. 569.
- LANDGREBE, K. L., on Brown furnace-top. 1917, i. 339.
- LANDIS, W. S., on briquetting of iron ore and flue-dust. 1913, i. 450.
 awarded Carnegie Research Grant. 1912, i. 27.
- LANDLESS, J. E., on the Burnley coal-field. 1914, i. 598.
- LANDRUM, R. D., on enamelling of iron and steel. 1912, ii. 581; 1913, i. 654.
- LANDSBERG, on briquetting of brown coal. 1921, ii. 359.

- LANE, A. C., on economics of mining. 1913, i. 577.
- LANE, H. M., on casting of pipe fittings. 1921, ii. 373.
 on core-room practice. 1913, ii. 607.
 on foundry cores. 1911, ii. 566; 1912, i. 520, ii. 545; 1916, i. 342.
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 on foundry practice. 1913, i. 617.
 on cleaning foundry sand. 1917, i. 350.
 on physical changes in cast iron during cooling. 1911, i. 642.
 on portable cupola for emergency work. 1912, i. 512.
 on sand binders. 1915, ii. 270.
- LANE, W. T., on by-product coke-ovens. 1920, ii. 330.
 on fuel economy. 1919, ii. 472.
- LANEY, F. B., on flaky and woody steel. 1919, i. 692.
- LANG, A., on composition of graphite. 1915, i. 500, ii. 226.
- LANG, E. F., on crystalline structure of steel. 1912, i. 580.
 on history of Bessemer process. 1913, i. 630; 1914, i. 677.
 on steel foundry practice. 1917, i. 355; 1918, ii. 467.
- LANG, G., on properties of manganese steel. 1911, i. 666.
- LANG, H., on direct process. 1921, ii. 367.
- LANG, K., on pressure on rolls of rolling-mills. 1916, i. 354.
- LANG, W. R., on coal-dust experiments. 1911, ii. 534.
- LANGDON, S. C., on embrittling effects of pickling. 1920, i. 755.
 on passivity of iron. 1913, ii. 694; 1915, i. 627.
- LANGE, F., on blast-furnace practice. 1915, i. 555.
 on coke consumption in blast-furnaces. 1918, ii. 461.
 on powdered coal in blast-furnace. 1916, ii. 418.
 on recovery of cyanide of potassium from the blast-furnace. 1917, ii. 395.
 on use of raw coal-dust as blast-furnace fuel. 1915, i. 546.
- LANGE, O., on durability of converter linings. 1911, ii. 587.
 on use of silica bricks for open-hearth furnaces. 1913, i. 527.
- LANGE, W., on metallic coatings. 1921, ii. 416.
- LANGENBERG, F. C.—
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 on microstructure of electric pig iron. 1912, ii. 585.
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- LANGER, M., on utilisation of blast-furnace gas. 1912, i. 500.
- LANGFORD, T. H., on magnetic properties. 1911, ii. 632.
- LANGHAMMER, A. J., on tests of high-speed steels. 1920, ii. 384.
- LANGHEINRICH, E., on blast-furnace operations. 1912, i. 496.
- LANGLEY, S. S., on cost of drilling petroleum-wells. 1920, i. 701.
- LANGMUIR, J., on theory of combustion. 1914, i. 593.
- LANGROGNE, E., on iron in Lorraine. 1920, ii. 307.
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- LANGSTROTH, C. B., on steel for rifle barrels. 1917, i. 390.
- LANGTON-WOOD, HERBERT, elected member. 1914, i. 3.
- LANGTRY, W. D., on coal storage. 1920, ii. 341.

- LANINO, P., on metallurgical industries of Italy. 1920, i. 705.
- LANNING, L. A., on effect of elements on steel. 1921, ii. 405.
elected member. 1921, i. 3.
- LANTSBERRY, F. C. A. H., on briquetting coals. 1917, i. 336.
on critical ranges of pure iron. 1913, i. 348.
on elastic strength of metals. 1915, i. 600.
on hardening and annealing of steels. 1911, i. 634.
on hardening and tempering of alloy steels. 1915, ii. 40 ; 1918, i. 528.
on high-speed steels. 1915, i. 605.
on influence of elements on cast iron. 1920, ii. 380.
on influence of metalloids on properties of cast iron. 1913, i. 377.
on tenacity and deformation of steel at high temperatures. 1913, i. 290.
awarded Carnegie Research Grant. 1914, i. 24.
- LANZA, G., on elastic limit and yield-point definitions. 1916, ii. 448.
on testing full-size pieces and locomotive testing. 1912, ii. 381.
- LAPATNICK, AARON, elected associate. 1917, i. 6.
- LAPONCHE, A., on compressed air in collieries. 1913, i. 570.
- LAPWORTH, A., on critical ranges of pure iron. 1913, i. 349.
- LARARD, CHARLES EDWARD, on plastic flow of ductile material. 1913, i. 662.
elected member. 1913, i. 3.
- LARDIN, on moulding machines. 1911, ii. 568.
- LARKE, SIR W. J., on direct current compared with three-phase current for driving steelworks' plant. 1920, i. 260.
- LARSEN, E. S., on molybdenum in New Mexico. 1921, i. 375.
- LASCHINGER, E. J., on rock-drills. 1914, i. 580.
- LASIUS, J., on casting of stove plates. 1912, i. 523.
- LASPIERE, J. T., on coal in Germany. 1918, ii. 451.
- LASSEN, JENS JAKOB, elected member. 1914, i. 3.
- LASSKOWSKI, J., on composition of raw metal for tinplate. 1912, i. 589.
- LASZCZYNSKI, invention of new explosive by. 1912, ii. 459.
- LATER, E. P., on nickel-plating. 1918, i. 556.
- LATHE, F. E., on training the works' chemist. 1917, i. 422.
- LATKIN, V., on petroleum in Russia. 1915, i. 520.
- LATTA, N., on gas-producers. 1911, i. 560.
- LAUNAY, L. DE, on origin of iron ore. 1911, ii. 468 ; 1913, ii. 494.
- LAUR, F., on coal in France. 1915, i. 507.
on oil-fields of the world. 1911, i. 557.
- LAURENCE, J. N., on composition of coal. 1912, ii. 478.
- LAURENT, THÉODORE, elected member. 1914, ii. xix.
- LAURIE, F., on method for closing oil-well. 1912, ii. 499.
- LAURIOL, P., on calorimetry. 1917, ii. 361.
- LAUSCHKE, G., on melting point of zirconia. 1918, i. 556.
- LAUTZ, on influence of temperature on bending resistance of steel wire. 1917, i. 398.
- LAVAL, C. P., on use of small converters in foundries. 1913, i. 610.
- LAVAUD, D. S. DE, on cast-iron pipe manufacture. 1917, i. 353.
- LAVELEYE, BARON DE—

Paper on "Historical survey of the metallurgy of iron in Belgium." 1913, ii. 8 ; period of first extraction of iron ores, 9 ; primitive furnaces used in manufacture of iron, 11 ; progress of industry in Liege after Burgundian invasion, 15 ; introduction of use of coke in the blast-furnace,

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on history of iron. 1912, i. 508.

LAVELL, W. L., on electro-plating with cobalt. 1915, ii. 327.

LAVENDER, JOHN HERBERT, elected member. 1917, ii. 3.

LAVENE, H. A., on electrically-heated bomb furnace. 1916, i. 400.

LAVERICK, J. G. W., on coke-oven gas. 1920, i. 703.

LAVOIE, G. A., on occurrences of gas in coal-beds. 1915, i. 537.

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on influence of oxygen on alloys. 1913, i. 675.

on production of sound steel by lateral compression of the ingot. 1918, i. 235.

LAW, E. F., W. H. MERRETT and W. P. DIGBY—

Paper on "Some studies of welds." 1911, i. 103 ; bibliography, 104 ; resistance welds, 106 ; hot-flame welds with acetylene, 109 ; hot-flame welds with water-gas, 111 ; thermit welds, 113 ; welded steam-pipe flanges, 113 ; conclusion, 115.—*Discussion* : A. E. Tucker, 117 ; T. Turner, 118 ; H. Le Chatelier, 118 ; J. E. Stead, 119 ; A. T. Jenkins, 119.—*Correspondence* : T. Vaughan Hughes, 120 ; R. Stutz, 121 ; R. J. Wallis-Jones, 122.

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LAWRENCE, B. B., on iron ore in Cuba. 1911, i. 521.

LAWRENCE, J. C., on manufacture of charcoal and products of distillation. 1918, i. 485.

LAWRENCE, S. E., on thermit welding process. 1912, ii. 578.

LAWS, E. H., on special sintering machine. 1914, ii. 279.

LAWSON, SIR ARTHUR T., BART., obituary notice of. 1915, i. 461.

LAWSON, T. R., on thermo-electric indication of strain as a testing method. 1912, ii. 382.

LAYCOCK, WILLIAM ERNEST, elected member. 1914, i. 3.

LAYNE, T. E., on low-temperature carbonisation of coal. 1920, i. 698, ii. 327 ; 1921, i. 390.

LAYTON, GORDON, elected member. 1913, ii. 4.

LAYTON, WALTER THOMAS, elected member. 1920, i. 4.

LAZENNEC, I., on testing of petroleum. 1921, ii. 356.

LAZURTEGUI, J DE, on iron resources of the world. 1912, ii. 644.

LEA, F. C., on change in density of steel by compression beyond the yield point. 1915, ii. 304.

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LEADBEATER, EDWIN, obituary notice of. 1914, i. 554.

- LEAHY, F. E., on fuel requirements of steel mills. 1921, ii. 344.
- LEASMAN, E. L., on annealing of malleable castings. 1913, ii. 642 ; 1914, ii. 356.
- LEATHER, J. P., on refractories in gasworks. 1918, i. 476.
- LEATHERBEE, B., on vanadium ore in New Mexico. 1911, i. 525.
- LEBER, E., on cupola practice. 1912, i. 513 ; 1914, i. 657.
on a French foundry. 1912, ii. 550.
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on strength of materials. 1912, i. 569.
on transport equipment for foundries. 1913, ii. 609.
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- LEBER, J., on a French foundry. 1912, ii. 550.
on large castings. 1915, i. 565.
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- LEBLANC, M., on phenomena of passivity. 1914, i. 737.
- LEBOUR, G. A., on geology of coal. 1916, ii. 394.
- LEBRUN, M., on electric arc welding. 1921, ii. 394.
- LECESNE, M. N., on preparation of bauxite. 1917, ii. 355.
- LE CHATELIER, H., on action of iron oxides upon acid furnace structure. 1919, ii. 183.
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on blast-furnace reactions. 1912, ii. 521.
on Brinell hardness and tenacity factors of heat-treated special steels 1915, i. 137.
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on hardness measurements. 1917, ii. 436.
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on hydrogen in blast-furnace gases. 1911, i. 582.
on influence of rate of cooling on transformation points. 1917, ii. 423.
on the iron-carbon system. 1911, ii. 648 ; 1914, i. 725.
on iron and steel of ancient origin. 1912, i. 180.
on magnetic and mechanical properties of manganese steel. 1914, i. 125.
on magnetic transformation point of iron. 1915, i. 245.
on mechanicalising analysis. 1911, ii. 660.
on metallography and macrography. 1912, i. 579 ; 1915, ii. 322 ; 1919, ii. 527.
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on properties of aluminous materials. 1920, i. 683.
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- LE CHATELIER, H., on properties of silica. 1913, ii. 525.
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 on solubility of cementite in hardenite. 1912, i. 246.
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 on transformation of impact energy into heat in shock-testing. 1915, i. 603.
 on transformations of steel during heat-treatment. 1911, ii. 59.
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 on woody fractures in transverse tests. 1919, ii. 224.
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 elected member of Council. 1915, i. 14.
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- LE CHATELIER, L., on bauxite as a refractory. 1917, ii. 355.
- LE CHATELIER, R., on blast-furnaces in Normandy. 1913, i. 589.
- LECOCQ, E., on analysis of coke-oven gas. 1911, i. 690.
 on coking practice. 1913, ii. 549; 1916, ii. 399.
 on hardness of coke. 1911, i. 550.
 on heat losses by absorption in coking-ovens. 1914, ii. 292.
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- LECOCQ, L., on use of coke-oven gas. 1919, ii. 481.
- LECONTE, on pyrometry. 1912, i. 458.
- LÉCRIVAIN, M., on extinction of underground fires. 1914, i. 630.
 on storage of coal. 1911, i. 574, ii. 536.
- LECRON, E., on use of synthetic pig iron. 1921, ii. 369.
- LEDINGHAM, JOHN MACHRAY, obituary notice of. 1912, ii. 433.
- LEDINGHAM, L. N., on electric furnaces. 1913, ii. 358.
- LEDNICKY, V. E., on iron ore in the Philippines. 1916, i. 291.
- LEE, F. C., on use of timber in coal-mines. 1917, ii. 383.
- LEE, G. M., on direct process of steel-making in the electric furnace. 1911, i. 626.
- LEE, G. P., on metallic coating of metals. 1913, i. 653.
- LEE, G. W., on iron ore in Scotland. 1920, i. 668 ii. 306.
- LEE, H. R., on a new chemists' slide rule. 1914, i. 746.
- LEE, J. W., on chemistry of coke-oven operation. 1915, i. 514.
- LEE, R. H., on use of nodulised ore in the blast-furnace. 1914, i. 638.
- LEE, WEE KUA, elected member. 1919, i. 4.
- LEE, W. T., on coal in New Mexico. 1914, i. 602.
 on coal-fields of Colorado. 1913, ii. 542.
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- LEE, WEN-WHAI, elected member. 1918, ii. 3.
- LEEDS, M. E., on determination of transformation points in steel. 1915, ii. 320.
 on rate of cooling of steel specimens of different sizes. 1915, ii. 294.
- LEES, G. E., on production of alloy steels in United States. 1911, ii. 680.
- LEES, JOSEPH BRADSHAW, elected member. 1914, ii. xix.
- LEES, LEWIS WILLIAM, elected member. 1921, i. 3.
- LE FEVRE, S., on magnetic concentration of low-grade ores. 1917, i. 290.
- LEFFLER, J. A., on crude oil as metallurgical fuel. 1920, ii. 338.
 on electric smelting of iron ore. 1911, ii. 548; 1912, i. 507, ii. 530; 1915, ii. 264; 1917, ii. 393; 1918, i. 495.
 on wood fuel for open-hearth furnace. 1915, i. 572.

- LEFFLER, J. A., elected member. 1911, i. 3.
- LEFROY, E. M., on tungsten ore in Burma. 1915, i. 489.
- LEGG, JOHN GORDON, elected member. 1921, i. 3.
- LEGGAT, J., on equipment of collieries. 1914, i. 623.
- LEGRAND, on impact tests. 1921, i. 455.
- LEGRAND, C., on haulage in collieries. 1914, i. 626.
- LE GRIS, on micrographic examination of small particles of metal. 1911, ii. 633.
on structure of titanium and aluminium alloys. 1911, ii. 638.
- LEHMANN, M., on winding-engines. 1913, i. 573.
- LEIGH, A. L., on cleaning of blast-furnace gas. 1918, i. 493; 1921, i. 96.
- LEISER, H., on world's production of tungsten. 1912, i. 637.
- LEISSE, F., on use of coal-dust in moulding. 1914, i. 664.
- LEITER, S. B., on case-hardening. 1921, i. 435.
- LEITH, C. K., on conservation of iron ores in America. 1916, i. 298.
on geology of ore deposits. 1913, i. 507.
on iron ore in Brazil. 1912, i. 439.
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on iron ore in Michigan. 1913, ii. 505.
on valuation of low-grade ores. 1914, i. 582.
on world's consumption of iron ores. 1914, i. 772.
- LELAND, E. D., on storage of natural-gas. 1912, ii. 501.
- LELLEP, O., on oxidation of metals. 1921, ii. 392.
- LEMAIRE, C., on coal in Holland. 1921, i. 384.
on mining and metallurgical industry of Luxemburg. 1921, i. 406.
- LEMAIRE, E., on explosions in collieries. 1911, ii. 535.
on gases in collieries. 1911, i. 371.
on Goulet safety-lamp. 1913, ii. 569.
on lighting of collieries. 1911, i. 574; 1912, i. 488.
- LE MAISTRE, C., on standardisation of materials. 1916, ii. 451.
- LE MESSURIER, H. W., on petroleum in Newfoundland. 1912, i. 474.
- LEMIERE, L., on origin of coal. 1911, i. 541.
- LEMMY, G. K., on steel ingot defects. 1916, ii. 207.
- LEMOINE, J., on heterogeneity of steel. 1916, i. 387.
- LENGFELDER, H. W., on moulding machines. 1914, ii. 331.
- LENHER, V., on estimation of titanium. 1912, ii. 625.
on manufacture of silica bricks. 1912, ii. 471.
- LENNINGS, P., on use of oil fuel in foundry practice. 1913, ii. 600.
- LENNOX, JOHN, elected member. 1917, ii. 3.
- LENT, L. B., on producer-gas. 1911, i. 561, ii. 525.
- LENT, R. J. W., on roasting iron ore. 1913, ii. 521.
- LENTZ, A., on the Bonvillain moulding-machine. 1912, ii. 547.
- LEO, K., on sulphate of ammonia recovery. 1914, i. 607.
- LEOBELL, H., on uses of petroleum. 1911, ii. 519.
- LEONARD, R. W., on manufacture of nickel-copper steel from Sudbury ores. 1918, ii. 475; 1921, i. 422.
- LEPAPE, A., on gases in mines. 1912, i. 488; 1914, ii. 311.
- LEPRINCE-RINGUET, F., on absorption of gases by coal. 1914, i. 597.
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- LEPSOE, R., on rapid determination of carbon in iron and steel. 1915, i. 631.

- LE RENÉ, on coal briquetting. 1918, i. 488.
- LESHER, C. E., on briquetting coals. 1917, i. 336.
 on coal industry of the United States. 1916, ii. 470.
 on coke industry of the United States. 1916, ii. 401.
- LESLIE, M. D., on iron wire for electric transmission. 1918, i. 549.
- LESLIE, ROBERT MACBETH, on definition of hardness. 1919, i. 683.
 elected member. 1919, i. 4.
- LESOURD, G., on Schoop process of coating metals. 1914, i. 739
- LESSELLS, JOHN MOYES, elected member. 1916, i. 3.
- LESSING, R., on coking tests of coal. 1912, ii. 488.
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- LESTER, I. E., on cooling of steel in ingot and other forms. 1918, ii. 276.
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- LESTER, WALTER, elected member. 1912, i. 3.
- LETZOUS, on mineral resources of Jugo-Slavia. 1921, i. 373.
- LEUENBERGER, E., on influence of manganese on malleable cast iron. 1921, i. 451.
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- LEVEQUE, on history of the Decazeville ironworks. 1916, ii. 420.
- LEVI, A., on estimation of manganese. 1919, ii. 539.
- LEVICK, CHARLES ENSOR, elected member. 1920, ii. 4.
- LEVIN, A. M., on flow of oil in pipes. 1914, ii. 301.
- LEVIN, M., on blast-furnace reactions. 1912, i. 495, ii. 521.
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- LEVINGS, J. H., on blast-roasting of sulphide ores. 1913, ii. 521.
- LEVOZ, T., on Levoz converter. 1911, i. 597.
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- LEVY, A. G., on cellular structure of hypo-eutectoid steel. 1912, ii. 605.
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 on life history of pro-eutectoid cementite. 1912, ii. 382.
 on plastic deformation of steel. 1914, i. 703.
 Paper: "Notes on Pearlite." See HOWE, H. M.
- LEVY, DONALD M.—
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LEVY, L. A., on estimation of carbon monoxide. 1912, i. 612.

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LEWES, V. B., on chemistry of coke. 1912, i. 470.

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on smoke abatement. 1911, i. 540.

LEWIS, C. M., on coal-briquetting. 1915, i. 541.

LEWIS, DARTREY, elected associate. 1921, ii. 12.

LEWIS, ESSINGTON, elected member. 1921, i. 3.

LEWIS, E. A., on electrolytic analysis. 1914, ii. 392.

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LEWIS, H. W., on history of mining. 1913, ii. 518.

LEWIS, J., on history of iron. 1912, i. 508.

LEWIS, J. O., on prevention of underground wastes in oil and gas-wells. 1917, i. 324.

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LEWIS, J. F. P., on foundry mixtures. 1911, i. 593.

LEWIS, JOHN SAMUEL, elected associate. 1919, i. 6.

transferred to full membership. 1921, i. 6.

LEWIS, J. V., on chromite in United States. 1920, i. 674.

LEWIS, K. B., on history of wire manufacture. 1914, i. 686.

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LEWIS, ROBERT ARTHUR, elected member. 1916, i. 3.

LEWIS, R. S., on coal-fields of Utah. 1915, i. 509.

LEWIS, THOMAS OSWALD, elected member. 1918, i. 4.

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LEWIS, WILLIAM EDMUND JENKYN, elected member. 1919, i. 4.

LEWIS, W. K., on corrosion of iron and steel. 1912, ii. 609.

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- LEYDE, O., on foundry economics. 1913, i. 617.
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- LEYSANT, H., on estimation of vanadium. 1911, ii. 659.
- LEYVAL, H., on electric winding-engines. 1915, i. 533.
- LIÉRAUD, A., on preparation of ores. 1921, ii. 339.
- LI, N. H., on electrolytic iron. 1915, i. 623.
- LIAS, L., on shape of fuel briquettes. 1919, ii. 482.
- LIBERT, J., on application of electricity to coal-mining. 1915, i. 533.
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- LIBBY, S. H., on electric motors and controllers for the foundry. 1914, ii. 334.
- LICHTENBERG, E. B., on the Kent coal-field. 1915, i. 506.
- LICHTNER, W. O., on compression machine for testing concrete specimens. 1915, i. 604.
- LICHTY, L. C., on heat transmission of building materials. 1918, ii. 445.
- LIDDELL, D. M., on graphic calculation of blast-furnace slag composition. 1914, ii. 395.
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- LIDGETT, A., on economics of the petroleum industry. 1913, i. 559.
- LIDOFF, A., on manufacture of coke. 1912, ii. 489.
- LIEBER, H., on manufacture and uses of blaugas. 1914, i. 619.
- LIEBREICH, E., on corrosion of iron. 1912, ii. 610; 1913, ii. 691.
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- LIEBRICH, A., on the negative value of silica in iron ore. 1917, ii. 388.
- LIEDGENS, J., on influence of arsenic on steel. 1913, i. 674.
- LIENAU, O., on ore-handling. 1911, ii. 488.
- LIERQ, F., on chemistry of coke. 1912, i. 470.
- LIESCHING, T., on the iron-carbon-sulphur system. 1911, i. 666.
- LIÉVENIE, E., on manufacture of ferro-alloys. 1921, i. 406.
- LIEFFA, A., on iron ore in Hungary. 1911, i. 517.
- LIGGETT, T., on sherardising process. 1912, ii. 580.
- LILGE, F., on blast-furnace equipment. 1914, i. 645.
- LIMBERG, T., on utilisation of brown coal. 1921, i. 395.
- LINBARGER, S. C., on carborundum. 1919, i. 627.
- LINCIO, G., on dolomite. 1912, i. 456.
- LINCOLN, J. F., on electric welding. 1913, i. 651; 1915, i. 592; 1919, i. 678.
- LINCOLN, P. M., on prevention of overloads in mill motors. 1920, i. 728.
- LINCOLN, R. B., on pyrometry. 1919, i. 635.
- LINDBERG, MAGNUS, on early tilting open-hearth furnace. 1914, i. 673.
- LINDEMAN, E., on iron ore in Canada. 1914, i. 571; 1915, i. 483, 484; 1918, ii. 431.
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- LINDEMANN, W. C., on pickling and enamelling. 1920, ii. 378.
- LINDEMUTH, FRANCIS LLOYD, elected member. 1919, i. 4.
- LINDEMUTH, L. B., on electric furnace practice. 1920, i. 717, 718.
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- LINDER, EMILE, elected member. 1914, i. 3.
- LINDGREN, J. M., on estimation of boron in iron. 1915, ii. 330.

- LINDGREN, J. M. on estimation of nickel. 1912, i. 605.
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- LLOYD FRANCIS ZACHARY, obituary notice of. 1921, ii. 330.
- LLOYD, FREDERIC, elected member. 1917, i. 3.
- LLOYD, F. H., obituary notice of. 1916, i. 273.
- LLOYD, G. C., on meeting of learned and technical societies in Cornwall. 1912, ii. 363.
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- LLOYD, H., on coal-dust experiments. 1911, ii. 534.
- LLOYD, HENRY DAVID LLEWELLYN, elected member. 1913, i. 3.
- LLOYD, JOHN HENRY, obituary notice of. 1915, i. 462.
- LLOYD, M. G., on magnetic properties of iron alloys. 1911, i. 659.
- LLOYD, RICHARD, elected member. 1919, i. 4.
- LLOYD, S. J., on the Jurassic ironstones of the United Kingdom. 1918, i. 123.
- LLOYD, TREVOR WYNDHAM, elected associate. 1917, i. 6.
- LLOYD, W. D., on colliery rescue work. 1914, i. 633.
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- LOBLEY, HENRY D., elected member. 1919, i. 4.
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- LOCKLEY, HERBERT HIRST LAMBERT, elected member. 1919, i. 4.
- LOCKYER, SIR N., on basic slag as affecting agricultural development. 1917, i. 368.
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- LODGE, LAURENCE WILSON, elected associate. 1917, i. 6.
- LODIN, A., on allotropy of iron. 1912, ii. 282.
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- LOEWENHERZ, B., on electric welding. 1911, i. 638.
- LOEWENSTEIN, L. C., on volume regulator for blast-furnace engines. 1918, i. 490.
- LOF, E. A., on electric equipment of collieries. 1913, i. 570.
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- LOHE, T., on tilting forehearth for cupolas. 1911, ii. 559.
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- LOHR, J. M., on base metal thermocouples. 1920, i. 636.
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- LOIRET, on gases in collieries. 1911, i. 571.
- LOISY, E. DE, on blast furnaces in France. 1913, i. 589.
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- LOMAS, C. S., on by-product coke-ovens. 1915, ii. 237.
- LOMAS, GEORGE ALBERT, elected member. 1914, ii. 19.

- LOMAX, J., on composition of coal. 1911, i. 541; 1913, i. 536.
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- LOMBARDI, M. E., on drilling for petroleum in California. 1915, i. 524.
- LONERGAN, J., on electric steel furnace practice. 1919, i. 666.
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- LONES, JOHN HUNT, elected member. 1919, i. 4.
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- LONSDALE, T. R., on gas-engines for use in collieries. 1915, i. 530.
- LOOMIS, G. A., on porosity and volume changes of firebricks. 1920, ii. 315.
- LOPPÉ, F., on the Schoop method of coating metals. 1912, i. 600.
- LORBER, J., on electrolytic separation of iron-magnesium alloys. 1914, ii. 383.
- LORD, E. C. E., on rust-proof slag paint. 1911, ii. 653.

- LORD, HENRY ALBERT, elected associate. 1918, i. 7.
- LORD, J., on cost of operating annealing furnaces. 1913, i. 645.
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- LOUVRIER, F., on direct production of steel. 1914, i. 653.

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- LÖWIG, L., on determination of tungsten. 1920, ii. 397.
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- LUDGATE, BERTRAM, elected associate. 1917, i. 6.
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- LUIGI, on application of volcanic heat for production of power. 1917, i. 308.
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- LUNDBERG, C., on electric steel foundry in America. 1919, i. 658.
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- LUNDEBERG, C. W., obituary notice of. 1911, ii. 456.

- LUNDELL, G. E. F., on determination of cobalt and nickel in cobalt steels. 1921, ii. 420.
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- LÜRMANN, F. W., on enrichment of blast with oxygen. 1912, i. 498.
- LUSH, A. H., on coal briquettes. 1912, i. 492.
- LUSK, JAMES, obituary notice of. 1916, i. 273.
- LUTES, J. S., on methods of iron-ore mining. 1913, ii. 517.
- LUTTS, C. G., on chain cables. 1921, i. 446.
- LUTZ, B. E. V., on American blast-furnaces. 1911, i. 586.
on iron trade statistics of the United States. 1911, i. 701.
- LUX, E., on silica bricks from quartzite rock. 1921, ii. 343.
- LUX, F., on coal resources of China. 1913, ii. 539.
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- LYDE, W. C., on sand-blasting of forgings. 1916, ii. 436.
- LYDER, E. E., on geology of gas-fields. 1917, ii. 372.
- LYLE, J. I., on drying air for the blast-furnace. 1913, ii. 580 ; 1914, i. 641.
- LYMAN, J., on electric furnaces. 1911, i. 588, ii. 589.
- LYMAN, T., on electric furnaces of special types. 1911, i. 621.
- LYMAN, W. H., on heat-treatment furnaces. 1921, ii. 388.
- LYMN, A. H., on development of the gas-producer. 1915, i. 528.
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- LYNCH, T. D., on cooling properties of quenching liquids. 1920, i. 731.
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- LYNDE, C. C., on an American blast-furnace. 1915, ii. 264.
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- LYNDON, G. W., on chilled cast wheels. 1917, ii. 442, 443.
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- LYON, D. A., on electric furnaces. 1914, ii. 340 ; 1915, i. 554, 574.
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- LYON, D. A., on microstructure of electric pig iron. 1912, ii. 585.
 LYON, F., on corrodibility of iron. 1912, ii. 381.
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- MAAS, R., on properties of electrolytic alloys of nickel and iron. 1914, i. 730, ii. 384.
 MABERY, C. F., on economics of petroleum. 1920, ii. 339.
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 on estimation of titanium in iron. 1913, ii. 703.
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 MACCALLUM, F. L., on distribution of titaniferous iron ore. 1921, ii. 337.
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- McCANCE, A., on quenching cracks. 1921, i. 267.
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- McCANN, J., on manipulation of coal-cutting machines. 1913, i. 571.
- MACARTNEY, WALTER C., elected member. 1920, ii. 4.
- McCARTY, E. P., on hydraulic stripping of iron ore. 1916, i. 299.
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- M'CASLIN, H. J., on foundry patterns and moulding. 1911, i. 600.
- McCLEARY, F. E., elected member. 1920, ii. 4.
- McCLINTOCK, A. E., on foundry patterns and moulding. 1912, i. 519.
- McCLINTON, J. S., on gas-producer practice. 1919, ii. 479.
- McCLOUD, J. L., on heat-treatment of steel. 1921, i. 440.
- MACCO, on methods of mining coal. 1911, i. 567.
- McCOLLUM, B., on electrolytic corrosion. 1913, ii. 690; 1914, i. 736. 1916, ii. 463.
- MACCOLLUM, N. S., on capacity of open-hearth furnaces. 1912, ii. 554.
- McCONNELL, J., on basic open-hearth practice. 1918, i. 510.
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- McCONNELL, R. G., on iron ore in Canada. 1916, ii. 376.
- McCORMICK, B. T., on electric driving of rolling-mills. 1912, i. 528.
- McCOSH, A. K., obituary notice of. 1916, i. 274.
- MACCOUN, A. E., on blast-furnace construction in America. 1915, i. 543.
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- McCRACKEN, R. F., on estimation of manganese. 1911, i. 686.
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- McCROSSIN, E. F., on iron ore dressing. 1911, i. 531.
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- McDERMOTT, F. A., on crucible furnaces. 1911, i. 616.
- McDERMOTT, G. R., on waste heat utilisation. 1921, i. 398.
- MCDONALD, G. B., on mine supports. 1912, ii. 509.
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- MCDONALD, P. B., on geology of Michigan iron ranges. 1913, ii. 495.
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- MACFARLAND, A. F., on estimation of chromium in ferro-chromium. 1917, i. 421.
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- McFARLAND, D. F., on alloys of chromium-copper-nickel. 1917, i. 405.
- McFARLAND, G. S., on case-hardening. 1921, i. 436.
- McFARLANE, G. C., on ventilation in collieries. 1911, i. 532.
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- McGHEE, G. W., on vanadium deposit in Michigan. 1915, i. 490.
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- McGRATH, J. W., on coal in Newfoundland. 1917, i. 312.
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- MACGREGOR, J. S., on steel tubing for use in aeroplane construction. 1917, i. 408.
- MACGREGOR, M., on coal in Scotland. 1920, i. 692.
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- MACGREGOR, W., on open-hearth furnaces for steel foundries. 1911, ii. 563.
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- MACGUFFIE, D. D., on manufacture of steel castings. 1921, i. 413.
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- McKAY, R. V., on blast-furnace practice. 1919, ii. 483.
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- MACKENZIE, ANGUS MOIR, elected member. 1920, i. 4.
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- MACKENZIE, R. H., on petroleum in Sinai Peninsula. 1913, i. 554.
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- MACKNESS, C. F., on electric hoisting in collieries. 1911, ii. 531.
- McKNIGHT, C., on molybdenum steel. 1921, ii. 404.
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- McLAUGHLIN, R. P., on petroleum in the United States. 1914, ii. 299; 1915, ii. 244; 1917, ii. 374.
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- MACLEOD-BROWN, J., on passivity of iron. 1913, i. 686.
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- McMILLEN, R. H., on estimation of oxygen of iron and steel. 1913, i. 690.
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- MAGNUSON, G., on distillation of wood. 1911, i. 549.
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- MAGNUSSON, C. E., on corrosion of iron in concrete. 1911, ii. 652.
- MAGRUDER, W. T., on cleaning of castings. 1912, i. 523.
on tests on welded bars. 1912, ii. 587.
- MAHIN, E. G., on inclusions in steel. 1920, i. 725; 1921, i. 429, 430.
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- MAHIN, F. W., on manufacture of briquettes in Holland. 1914, ii. 316.
- MAHLER, P., on estimation of carbon. 1911, ii. 656; 1912, ii. 618.
on gases in collieries. 1911, i. 571.
on oxidation of coal. 1914, i. 631.
- MAHLKE, A., on pyrometry. 1919, i. 635.
- MAHLMAN, O. L., on electrolytic pickling of steel. 1917, ii. 431.
- MAHOM, S. A., on Wetherbee concentrator. 1917, ii. 346.
- MAHON, J. J., on physical tests of rolled steel. 1919, i. 685.
- MAILHE, A., on technology of catalysis. 1913, ii. 686.
- MAILHOT, A., on molybdenite deposits in Quebec. 1920, i. 674.
- MAIN, ALEXANDER, elected member. 1921, i. 3.
- MAIN, S. A., on magnetic and mechanical properties of manganese steel. 1914, i. 133.
on shock tests. 1921, i. 454.
on X-ray examination of electrodes. 1920, i. 720.
on X-ray examination of metals. 1919, i. 690.
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- MAINOT-CAPLAIN, RENÉ AUGUSTIN P., elected member. 1911, ii. 10
- MAINPRICE, MAX REYNER, elected member. 1912, i. 3.
- MAINWARING, W. D., on corrosion tests of iron and steel. 1912, ii. 611.
on sampling of steel billets. 1913, i. 688.
- MAIR, G. J., obituary notice of. 1911, i. 499.
- MAIRE, R., on magnetic transformation of iron-carbon alloys. 1915, ii. 320.
- MAIRET, F. F., on utilisation of power at collieries. 1917, i. 307.
- MITCHELL, J., on estimation of phosphorus in steel. 1920, i. 763.
- MAITLAND, A. G., on coal in Western Australia. 1913, i. 544.
on iron ore in Western Australia. 1913, i. 517.
on mineral statistics of Western Australia. 1911, i. 692.
- MAJIMA, M., on molybdenum steel for guns. 1919, ii. 508.
on torsional deformation of steel bars. 1918, i. 538.
- MAJOR, R. M., on electrical production of alloys. 1920, i. 754.
- MALAGUTI, P., on estimation of chromium in steel. 1921, ii. 420.
- MALCHER, L. M., on oxy-acetylene welding for rolling-mill repairs. 1919, ii. 504.
- MALCOLM, W., on petroleum in Canada. 1914, i. 610; 1916, i. 317.
- MALCOLMSON, C. T., on coal briquetting. 1915, i. 541.
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- MALE, EDWARD, elected member. 1920, ii. 4.
- MALINOVSKY, A., on malinite process. 1920, ii. 316.
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- MALLINSON, A. B., on electric equipment of collieries. 1911, ii. 528.
- MALLOCH, G. S., on coal in Canada. 1912, i. 467.
- MALLOCK, A., on colours of tempered steel. 1919, i. 674.
- MALM, E., on iron ore in Sweden. 1915, ii. 216.

- MALONE, G. B., on welding castings. 1920, i. 737.
- MALOWAN, S. L., on determination of molybdenum. 1920, ii. 397.
- MANCHOT, W., on analysis of titaniferous ores. 1912, i. 610.
- MANFIELD, W. H., on Scottish oil shale industry. 1916, i. 317.
- MANICE, D. F., on history of puddling process. 1917, i. 346.
- MANLOVE, G. H., on acetylene welding of pipe joints. 1915, i. 593.
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- MANN, A., on producer-gas from low-grade fuel. 1912, ii. 503.
- MANN, A., on slag-breaking installation at Dillingen. 1916, i. 336.
- MANN, A. S., on powdered coal in forge furnaces. 1916, i. 307.
- MANN, R. L., on manganese ore in the United States. 1916, ii. 379.
- MANNABERG, M., on influence of elements on mechanical properties of steel 1916, ii. 122.
- MANNELL, JOHN ANDREW, elected member. 1914, i. 3.
- MANNING, I. A., on coal in Colombia. 1913, i. 543.
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- MANNING, V. H., on economics of petroleum. 1920, ii. 339.
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- MANNOK, CHARLES MICHAEL, elected member. 1919, ii. 3.
- MANSFIELD, G. R., on coal in Idaho. 1921, i. 385.
- MANTELLI, A. S., elected member. 1917, i. 3.
- MANTERFIELD, DAVID, elected associate. 1917, i. 6.
- MANZ, H., on preparation of vanadium. 1913, i. 694.
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- MAPPIN, G. E., on ore-handling. 1917, ii. 345.
- MARBAKER, E. E., on separation of tungsten and molybdenum. 1915, i. 633.
- MARBLE, W. H., on stainless steel. 1921, i. 447.
- MARCHAND, H., on autogenous welding. 1919, ii. 512.
- MARCHANT, E. W., on magnetic properties of iron and steel. 1913, i. 668.
- MARCHIONNESCHI, on estimation of nickel. 1914, ii. 392.
- MARCONETT, G., on gas-producer practice. 1919, ii. 479.
- MARCUSSON, J., on composition of tars. 1921, ii. 353.
- MARDEN, J. W., on zirconium. 1920, ii. 318.
- MARDUS, on Kupper's gas-producer. 1911, ii. 521.
- MARGERUM, C. E., on impact testing machine. 1921, ii. 396.
- MARGOSCHES, B. M., on estimation of nitrogen in coke. 1915, i. 635.
- MARICHAL, A. G., elected member. 1920, i. 5.
- MARKGRAF, H., on combustion of coke-oven gas in open-hearth furnaces. 1917, ii. 378.
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- MARKLE, D., on anthra-coal. 1921, ii. 353.
- MARKS, ARTHUR, elected member. 1914, i. 3.
- MARKS, L. S., on clinkering of coal. 1911, ii. 505; 1915, i. 505.
- MARPLES, NORMAN CHISHOLM, elected associate. 1921, i. 6.
- MARQUAND, H. S., on electric welding. 1919, ii. 513.
- MARRE, F., on recovery of tin from tinplate. 1913, ii. 649.

- MARRS, L. E., on determination of manganese. 1911, ii. 663 ; 1913, i. 693.
- MARS, G., on slag enclosures. 1913, i. 655.
- MARSAUT, J. B., on geology of coal. 1915, i. 506.
- MARSDEN, WALTER, elected member. 1920, i. 5.
- MARSH, JOHN LOCKWOOD, obituary notice of. 1915, ii. 205.
- MARSH, W. J., on electrolytic estimation of nickel. 1915, i. 632.
- MARSHALL, A. G., on coal-mining industry of Siberia. 1913, ii. 539.
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- MARSHALL, A. H., on electricity as a fuel saver. 1918, i. 481.
- MARSHALL, C. H., on elastic limit recorder. 1921, i. 451.
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- MARSHALL, C. W., on corrosion. 1915, i. 624.
Paper on "The influence of molybdenum upon the corrodibility of steel." See FRIEND, J. N.
Paper on "The influence of silicon on the corrosion of cast iron." See FRIEND, J. N.
Paper on "The relative corrodibilities of grey cast iron and steel"; and a *Note* on "The removal of rust by means of chemical reagents." See FRIEND, J. N.
- MARSHALL, E. E., on a blast preheater. 1918, i. 491.
- MARSHALL, F. D., on low-temperature carbonisation of coal. 1916, ii. 401 ;
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- MARSHALL, SIR HORACE (Lord Mayor), speech at Dinner by. 1919, i. 591.
- MARSHALL, P., on coal in Colombia. 1912, ii. 486.
- MARSHALL, S. M., on combustion of blast-furnace gas. 1915, ii. 252.
- MARSTRANDER, R., on iron ore in Uruguay. 1916, ii. 380.
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- MARTEIL, V., on pattern-making. 1913, i. 612 ; ii. 606.
- MARTEL, L., on a new method of boring. 1913, ii. 515.
- MARTELL, P., on history of basic process. 1911, ii. 587.
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- MARTELLI, A., on iron ore in Elba. 1912, ii. 447.
- MARTENS, A., on calibration of testing-machines. 1912, i. 568.
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- MARTENS, F., on corrugation of steel rails. 1913, ii. 673 ; 1920, i. 745.
- MARTIN, A., on moulding. 1912, ii. 544.
- MARTIN, A. H., on American electric steelworks. 1911, i. 627.
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- MARTIN, E., on analysis of bauxites. 1914, i. 748.
- MARTIN, FRANCIS GRIMSHAW, elected member. 1919, i. 5.
- MARTIN, G. C., on coal in Alaska. 1912, ii. 485.
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- MARTIN, G. F., on British blast-furnaces. 1911, ii. 545.
- MARTIN, G. L., on petroleum in Alaska. 1921, ii. 356.
- MARTIN, HUGH, elected member. 1917, ii. 4.
- MARTIN, H. E., on iron ore mining machinery. 1914, i. 580.
- MARTIN, JAMES A., elected member. 1912, ii. 6.
- MARTIN, L., on coal in the United States. 1911, ii. 510.

- MARTIN, L., on iron ore in Pennsylvania. 1911, ii. 478.
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- MARTIN, PIERRE, presentation of Bessemer medal to. 1915, i. 25.
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- MARTIN, S. S., on the duplex process. 1915, ii. 276.
- MARTIN, W., on solubility of carbon in nickel. 1912, ii. 604.
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- MARTLEW, S. G., on properties of solid fuel. 1917, i. 307.
- MARTON, G., on small ingots. 1912, i. 534.
- MARX, G. H., on strength of gear teeth. 1913, i. 668; 1916, i. 384.
- MASINI, R., on coal in Italy. 1921, i. 384.
- MASLIN, ERNEST SEBA, elected member. 1913, i. 3.
- MASLING, K., on iron ore in Germany. 1912, i. 431.
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- MASLOFF, A. N., on transformation points of nickel-chrome steel. 1918, ii. 501.
- MASON, ARTHUR FRANK, elected member. 1920, ii. 4.
- MASON, HENRY PARKER, elected member. 1917, ii. 4.
- MASON, L., on coal in Indo-China. 1911, ii. 508.
- MASON, R., on cupola construction. 1911, i. 591.
- MASON, W., on alternating stress experiments. 1916, i. 373; 1918, i. 537.
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- MASPÉRO, on existence of ancient iron and steel. 1912, i. 159.
- MASSE, R., on modern gas-producer practice. 1913, i. 565.
- MASSENEZ, C., on estimation of sulphur. 1913, i. 691.
- MASSOT, P., on high-speed tool steel. 1914, ii. 350.
- MATHER, K. F., on petroleum in United States. 1920, i. 700.
- MATHER, R., on Belgian iron and steel industry and the Great War. 1919, i. 45
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- MATHER, SIR WILLIAM, obituary notice of. 1920, ii. 303.
- MATHERS, F. C., on nickel-plating. 1917, ii. 430.
- MATHESIU, L., on reduction of iron by hot gases. 1914, ii. 320.
- MATHESIU, W., on blast-furnace hearths. 1921, i. 400.
 on blast-furnace reactions. 1914, i. 637.
 on carbon consumption in the blast-furnace. 1911, ii. 543; 1917, i. 338.
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 on high-blast heats in Mesaba practice. 1915, i. 544.
 on history of iron. 1912, i. 510.
 on iron ores containing arsenic. 1915, i. 488.
Paper on "The magnetic properties of manganese and nickel steels."
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- MATHEWS, C. D., on testing cast iron. 1911, i. 645.
- MATHEWS, J. A., on coefficient expansion of alloy steels. 1920, i. 753.
 on chromium magnet steel. 1917, ii. 445.
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- MATHEWS, J. A., on iron-copper-nickel alloys. 1911, i. 668.
on magnetic properties of alloy steels. 1915, i. 616.
on manufacture of high-speed steel. 1919, ii. 510; 1920, i. 751.
on molybdenum steels. 1921, i. 467, ii. 403.
- MATHEWSON, C. H., on applications of micrometry to alloys. 1914, i. 715.
- MATHEWSON, E. P., on pulverised coal. 1920, i. 690.
- MATHIAS, T. H., on roll turning. 1914, i. 685, 686.
- MATHIAS, W., on clay and loam deposits in Germany. 1921, i. 377.
- MATHU-THYS, D., on foundry patterns and moulding. 1911, i. 600; 1912, ii. 544.
- MATIGNON, C., on acid-resisting alloys. 1918, ii. 506; 1920, i. 759, ii. 395.
on metallurgy of tungsten. 1920, i. 674, ii. 312.
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- MATSON, G. C., on natural-gas in the United States. 1916, i. 231; 1917, i. 327.
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- MATSUBARA, A., on chemical equilibrium between iron, carbon and oxygen. 1921, i. 436.
- MATSUDA, T., on properties of annealed steel. 1916, ii. 448.
- MATSUMURA, T., on elasticity of cast iron. 1915, ii. 300.
- MATSUSHITA, T., on influence of manganese on properties of steel. 1919, ii. 530.
on physical constants of chromium steel. 1920, ii. 388.
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Paper on "The cause of quenching cracks." See HONDA, K.
- MATSUURA, HARUKICHI, elected member. 1919, ii. 3.
- MATTHEWS, ARTHUR, elected member. 1921, i. 4.
- MATTHEWS, R. R., on petroleum of California. 1914, ii. 299.
- MATTHEWMAN, FRED, elected member. 1920, i. 5.
- MATTHEWMAN, F. A., on reactions in the open-hearth furnace. 1913, i. 621.
on sulphur in open-hearth process. 1920, i. 715.
- MATTHIAE, K., on blast-furnace operations. 1911, i. 580.
- MATTINSON, H., on wear of rails. 1912, i. 572.
- MATWIEIEFF, on faulty boiler plates. 1914, i. 711.
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- MAULAND, S., on influence of sulphur in soft grey iron. 1918, i. 535.
- MAURER, E., on theories of hardening. 1921, i. 465.
- MAURICE, on composition of basic slag. 1915, ii. 283.
- MAURICE, W., on acetylene mine lamps. 1917, ii. 385.
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- MAVOR, S., on coal-dust experiments. 1911, ii. 534.
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- MAW, FRANCIS JOHN, obituary notice of. 1913, i. 488.
- MAWDSLEY, W. H., on blasting in collieries. 1913, i. 571.
- MAWSON, R., on cleaning of castings. 1914, ii. 332.
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- MAWSON, R., on oxy-acetylene welding. 1914, ii. 360, 361.
- MAXWELL, J. G., on kilns for burning firebricks. 1918, i. 478.
- MAXWELL, L. C., on determination of carbon in iron. 1921, i. 471.
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- MAXWELL-LEROY, E., on wolframite in Lower Burma. 1916, i. 297.
- MAY, W. J., on addition of phosphorus to metals. 1916, i. 339.
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on casting in permanent moulds. 1914, i. 665.
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- MAYER, A. R., on peat. 1911, i. 547.
- MAYER, C., on economics of steel manufacture. 1920, i. 723.
- MAYER, F., on cleaning blast-furnace gas. 1914, i. 642.
- MAYER, L., on microstructure of tinplate. 1919, i. 694.
- MAYER, W., on rise and progress of iron founding. 1913, i. 607.
- MAYNARD, GEORGE W., obituary notice of. 1913, i. 488.
- MAYO, CHARLES ROBERT, elected member. 1913, i. 3.
- MAYO, H. T., on geology of the Persian oil-fields. 1919, i. 642.
- MAYOH, F. H., on manufacture of chains. 1915, ii. 299.
- MAYRISCH, EMILE, elected member. 1921, ii. 10.
- MDIVANI, B., on estimation of tungsten. 1911, i. 687.
- MEACHAM, F. G., on development of Midland coal-fields. 1913, ii. 537.
- MEAD, A., on industrial uses of gas. 1913, ii. 641.
- MEAD, W. J., on iron ore in Cuba. 1911, ii. 480.
- MEADE, M. A., on preservation of iron and steel. 1912, i. 596.
- MEADE, R. K., on recovery of cyanide of potassium from the blast-furnace. 1917, ii. 395.
- MEANS, C. M., on explosives in collieries. 1916, i. 325.
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- MEASURES, H., on pouring castings. 1921, ii. 369.
- MECKLENBURG, W., on petroleum in Argentina. 1911, i. 557.
- MEERBACH, K., on formation of cracks in rolls. 1920, i. 728.
- MEGURO, S., on coal in Japan. 1915, ii. 233.
- MEHRTENS, J., on briquetting of iron ore. 1912, i. 451.
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- MEIKLE, G. S., on theory of combustion. 1914, i. 593.
- MEISSNER, on methods of working in collieries. 1911, ii. 529.
- MEISSNER, C. A., on by-product coke-ovens. 1914, ii. 292.
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- MEISSNER, H., on influence of elements on cast iron. 1914, i. 721.
- MEKER, G., on defective annealing owing to uneven surfaces of steel. 1915, ii. 294.
- MELANEY, W. H., on roll design. 1920, i. 729; 1921, i. 434.

- MELANEY, W. H., on roll turning. 1920, ii. 367.
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- MELLANBY, A. L., on uses of petroleum. 1914, i. 614.
- MELLOR, J. W., on action of flue-dust on firebricks. 1914, i. 590 ; 1919, i. 632.
on developments in refractory material production. 1919, ii. 466.
on estimation of firing temperature of refractory products. 1917, i. 293.
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on influence of heat on fireclay. 1911, ii. 495.
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- MENDEHALL, C. E., on pyrometry. 1920, i. 688.
- MENDEL, J., on petroleum resources of the world. 1911, ii. 682.
- MENEGHINI, D., on lignite in Italy. 1921, i. 384.
- MENZIES, J. F., on rescue appliances in collieries. 1914, i. 632.
- MERCENIER, M., on coal in Central Africa. 1913, ii. 539.
- MERCER, R. G., on electric furnace practice. 1919, i. 665.
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- MERICA, P. D., on duralumin. 1920, i. 755.
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- MÉRIGEAULT, E., on ventilating and pumping machinery. 1913, ii. 569.
- MERRETT, W. H.—
Paper on "Some studies of welds." See LAW, E. F.
- MERRIAM, E. S., on examination of gasoline in natural gas. 1914, i. 749.
- MERRIAM, F. E., on drop-forging dies. 1916, i. 362.
- MERRIAM, J. B., on recovery of heat losses in internal-combustion engines. 1915, i. 530.
- MERRICK, A. W., on refining of malleable iron in electric furnace. 1920, i. 710.
- MERRILL, G. P., on meteorites. 1913, i. 519, ii. 512, 513 ; 1915, ii. 222.
- MERTEN, W. J., on case-hardening. 1921, i. 435.
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- MERTES, A., on hardness testing. 1911, ii. 621.
- MERTHYR OF SENGHENYDD, LORD, obituary notice of. 1914, ii. 251.
- MERWIN, H. E., on chemical properties of hydrated ferric oxide. 1919, ii. 536.
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- MESNAGER, A., on nomenclature of some technical quantities. 1912, ii. 386.
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- MESSERSCHMITT, A., on growth of cast iron. 1914, i. 702.
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- MESSERSCHMITT, A., on the use of scrap iron briquettes. 1911, i. 595; 1912, i. 513.
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- MESSINGER, C. R., on steel foundry practice. 1918, i. 503.
- MESTA, G., on forging presses. 1911, ii. 573.
- MESTWERDT, A., on iron ore in Germany. 1913, ii. 497.
- METAYER, MAURICE, elected member. 1919, ii. 4.
- METZ, on design of sections. 1919, ii. 501.
- METZ, N., on blast-furnace reactions. 1913, i. 581.
- METZGER, F. J., on estimation of manganese. 1911, i. 686, ii. 663; 1913, i. 693.
- METZGER, J. J., JUN., on foundry cores. 1912, i. 520.
- METZL, A., on estimation of cobalt in presence of nickel. 1915, i. 633.
- MEUNIER, J., on explosions in collieries. 1911, i. 574.
- MEUNIER, S., on meteorites. 1912, i. 442, ii. 458.
- MEURICE, on determination of iron. 1921, ii. 420.
- MEURICE, A., on sampling of coal. 1912, i. 612.
- MEUSKENS, C., on shaft-sinking. 1912, ii. 508.
- MEUSS, P., on removing safety pillars in coal-mines. 1915, i. 534.
- MEUTHEN, A., on calorimetric investigation of iron-carbon system. 1913, ii. 683.
- MEYER, on gas-producers. 1912, i. 482.
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- MEYER, ALOYSE, elected member. 1921, ii. 10.
- MEYER, A. A., on electric steel practice. 1917, ii. 407.
- MEYER, A. R., on melting points of metals. 1912, ii. 607.
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- MEYER, C. F., on an annealing and hardening furnace. 1912, ii. 573.
- MEYER, E., on steel for locomotive fire-boxes. 1915, i. 612.
- MEYER, F. W., on speed control of motors for driving of rolling-mills. 1913, i. 639.
- MEYER, G., on power requirements of rolling-mills. 1915, i. 579.
- MEYER, G. A., on substitutes for benzine in safety-lamps. 1915, i. 537.
- MEYER, H., on heat-treatment of pearlitic nickel steels. 1915, i. 586.
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- MEYER, H. C., on ferro-zirconium. 1919, i. 697.
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- MEYER, K., on methods of working coal. 1913, ii. 567.
- MEYERHEIM, G., on estimation of asphalt in petroleum. 1914, ii. 396.
- MEYERS, H. K., on selection of fuel by analysis. 1911, i. 539.
- MEYERS, W., on grading of iron ores. 1914, ii. 278.
- MEYN, W., on utilisation of coke-oven gas. 1911, ii. 512.
- MEZGER, R., on calorific value of coal. 1921, i. 380.
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- MICHÆL, on temperatures at great depths. 1911, ii. 532.
- MICHEL, R., on estimation of lime in basic slag. 1911, i. 688.
- MICHENFELDER, C., on rolling-mill accessories. 1911, ii. 579.
- MICKLE, G. R., on composition of natural-gas. 1915, i. 527.
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- MICKS, P. R., on foundry accessories. 1915, ii. 274.
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- MYERS, C., on electric furnaces of special type. 1912, i. 542.
- MYERS, D. M., on fuel conservation. 1913, ii. 536; 1918, ii. 449; 1921, i. 381.
- MYERS, E. M., on equipment of coke-ovens. 1917, ii. 369.
- MYERS, F. B., on analysis of alloys of nickel and zirconium. 1917, ii. 464.
on estimation of tantalum. 1917, ii. 465.

- MYERS, F. B., on estimation of uranium. 1919, i. 701.
 MYLIUS, W. G., on regulation of arc furnaces. 1921, i. 424.

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- NACHTWEH, A., on moulds for the production of hollow castings. 1911, ii. 565.
 NADERHOFF, A., on coke-oven accessories. 1915, ii. 237.
 NADIN, R., on lighting of collieries. 1917, i. 333.
 NAEGLI, H., on analysis of gases in ironworks practice. 1912, i. 612.
 NAGEL, A., on uses of petroleum. 1911, ii. 519.
 NAGEL, O., on iron ore in Austria. 1914, ii. 266.
 on mine drainage. 1911, i. 570.
 NALLER, R. F., on enamelling of iron and steel. 1913, ii. 694.
 NAIR, THEKETH KUMARAN, elected member. 1916, ii. 2.
 NAISH, W. A., on scientific aspects of steel founding. 1916, i. 340.
 NALL, J., on foundry patterns and mouldings. 1911, i. 599, 600.
 NAMIAS, R., on determination of silicon in ferro-silicon. 1915, ii. 329.
 NANCOLLAS, HENRY PHILLIP, elected member. 1917, i. 3.
 NAPIER, J. W., on low-temperature carbonisation of coal. 1916, ii. 401.
 NAPOLITAN, F. J., on oxygen cutting. 1920, ii. 377.
 NASH, CLIFFORD, elected member. 1920, i. 5.
 NASINI, R., on estimation of molybdenum. 1912, ii. 624.
 on molybdenite in Italy. 1912, ii. 456.
 NASON, F. L., on origin of magnetic iron ores. 1912, ii. 446.
 NATHORST, H., on haulage in iron mines. 1915, i. 493.
 NATHORST, H. J. H., on concentration of iron ore. 1913, i. 524.
 NATHUSIUS, H.—
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 NAUMANN, A., on producer practice. 1917, ii. 379.
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 elected member. 1920, i. 5.
 NEAD, J. H., on case-hardening. 1913, i. 643.
 on influence of carbon on physical properties of steel. 1916, i. 371.
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 on tension tests on nickel steel. 1921, i. 456.
 elected member. 1911, ii. 10.
 NEAL, R. O., on petroleum mining. 1919, i. 643.
 NEALE, J. C., on history and development of the steel wheel. 1914, i. 661.
 NEALE, R. E., on coal-handling. 1911, i. 578.
 on Powell process for preservation of timber. 1914, i. 622.
 NEAVE, A. A., on rope-drive for rolling-mills. 1911, ii. 578.
 NEBEL, M. L., on the specific gravity of coal. 1917, i. 309.
 NEEDHAM, W., on moulding large condenser pipes. 1911, ii. 566.

- NEELY, GLEN WAYNE, elected member. 1921, i. 4.
- NEILL, C. P., on conditions of employment in American iron and steelworks. 1913, ii. 725.
- NELSON, G. H., on manufacture of crucible steel. 1914, ii. 336.
- NELMS, H. J., on mine ventilation. 1911, i. 570.
- NELSON, A. C., on distribution of the charge in blast-furnaces. 1917, i. 339.
- NELSON, ANDREW SOLANDERS, obituary notice of. 1913, i. 490.
- NELSON, B. S., on combustion of liquid fuel. 1917, ii. 376.
- NELSON, J., on foundry costs. 1912, ii. 552.
- NELSON, R., on coal-cleaning. 1921, ii. 359.
on mechanical power in mines. 1913, i. 571.
on use of electricity in mines. 1915, i. 533.
- NELSON, TOM HOLLAND, elected member. 1920, i. 5.
- NELSON, T. J., on prevention of electrical accidents in mines. 1915, i. 539.
- NEMINGER, L. F., on drawings for the pattern-shop. 1918, i. 351.
- NEOGI, P., on early manufacture of iron in India. 1915, i. 555.
- NESBIT, A. F., on gas-cleaning. 1917, i. 341.
- NESBITT, C. E., on firebricks 1916, ii. 386; 1920, i. 678, 679.
on specifications of refractory bricks. 1918, ii. 443.
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- NESBITT, C. T., on costs of production in the electric furnace. 1914, ii. 340.
on estimation on manganese. 1917, ii. 464.
elected member. 1921, i. 4.
- NESS, J., on petroleum in Canada. 1921, ii. 355.
- NEU, K., on rolling iron and steel. 1912, i. 550.
on rolling of steel ingots while semi-fluid. 1912, ii. 569.
- NEUBAUMER, H., on estimation of phosphoric acid. 1912, ii. 627.
- NEUBERGER, H., on geology of petroleum. 1913, i. 551.
- NEUBERT, J. V., on copper in steel. 1920, ii. 394.
- NEUFANG, E., on a new design of cupola. 1913, ii. 594.
- NEUMANN, B., on balance of the blast-furnace. 1917, i. 338.
on base metal industry. 1916, ii. 472; 1919, i. 703.
on composition of blast-furnace slag. 1911, i. 590.
on electrical production of pig iron. 1912, ii. 531.
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on heat balance of electric smelting furnace. 1916, i. 335.
on iron industry. 1914, i. 773.
on magnetic and mechanical properties of pure electrolytic iron. 1915, i. 616.
on manufacture of aluminium in Germany. 1918, ii. 510.
on metal industry. 1915, i. 659; 1918, ii. 511.
on slag cement. 1919, i. 654.
on specific heat of gases. 1919, ii. 471.
on world's production of iron and steel. 1913, i. 718.
on world's production of metals. 1914, i. 773.
- NEUMANN, G., on heat currents in stoves and regenerators. 1921, i. 404.
on reversing valves for open-hearth furnaces. 1911, i. 619.
- NEUMANN, K., on tests on producer-gas power plant. 1911, ii. 525.
- NEUMANN, R., on American coal-washing machines. 1913, ii. 575.
on blast-furnace working. 1918, i. 489.

- NEURAY, L., on pyrometry. 1920, ii. 320.
- NEUSTADTER, D., on blast-furnace gas purification. 1914, i. 332.
on utilisation of blast-furnace gas. 1914, i. 643.
elected member. 1911, i. 3.
- NEWALL, ARCHIBALD PARK, elected member. 1917, ii. 4.
- NEWBERY, E., on corrosion and electrical properties of steels. 1917, i. 418.
- NEWCOMB, R. E., on foundry equipment. 1918, i. 508.
on testing high-speed steels. 1912, ii. 588.
- NEWCOMB, R. W., on pyrometer porcelains. 1920, i. 688.
- NEWELL, EDWIN FRANK, elected member. 1919, ii. 4.
- NEWELL, H. D., on segregation in bars. 1921, i. 429.
- NEWLAND, D. H., on moulding sand. 1915, ii. 270.
- NEWTON, DAN., elected member. 1918, i. 4.
- NEWTON, E., on manganese ore in United States. 1919, i. 622, 623.
on use of manganiferous iron in open-hearth practice. 1918, i. 511.
- NEWTON, JAMES STODDARD, elected member. 1918, i. 4.
- NEWTON, L. V., on classification of coal. 1912, ii. 474.
- NEY, A. H., on manufacture of synthetic phenol and picric acid from coal-tar products. 1915, ii. 238.
- NIBECKER, K., on rolling-mill engine. 1915, i. 577.
- NICHOLAS, U. J., on corrosion of iron in concrete. 1911, i. 676.
- NICHOLLS, J. H. H., on analyses of Canadian fuels. 1918, ii. 450.
- NICHOLSON, F., on alloy steels for motor-car construction. 1915, i. 613.
on case-hardening. 1913, ii. 637.
elected member. 1918, ii. 3.
- NICHOLSON, N. A., on coal in Nova Scotia. 1912, ii. 484.
- NICKLIN, M. E., on manufacture of sulphate of ammonia. 1921, i. 389.
- NICOL, E. W. L., on coke as boiler fuel. 1916, ii. 403; 1917, ii. 371.
- NICOLARDOT, P., on analysis of coal. 1912, ii. 627.
on analysis of oil shale. 1919, ii. 541.
on commercial analyses and tests. 1919, ii. 540.
on estimation of alumina in aluminium. 1912, ii. 621.
on estimation of gaseous volumes during reactions. 1919, ii. 541.
on estimation of magnesia. 1919, ii. 541.
on estimation of manganese. 1918, ii. 539.
on Schoop process. 1921, ii. 417.
- NICOLS, J. R., on shearing strength of steel. 1913, ii. 655.
- NICOU, P.—
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- NICOU, P., on economics of iron ore mining. 1915, i. 494.
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- NIDERAU, C., on electrically-driven coal-cutting machines. 1913, ii. 566.
- NIEDERSTADT, on composition of natural-gas. 1915, ii. 247.
- NIEDNER, L. C., on influence of machining on tensile tests of bars. 1915, i. 599.
- NIEDT, H., on composition of blast-furnace gases. 1912, i. 499.
- NIELSEN, B., on coal-tar as fuel. 1916, i. 306.
- NIEMKOF, G., on pipe in bottom-poured ingots. 1921, i. 428.
- NIMAL, H. DE, on Belgian iron trade statistics. 1911, ii. 673.
- NISBET, J., on shaft-sinking at Dykehead colliery. 1916, i. 325.
- NISHIKAWA, S., on radiography of metals. 1921, ii. 409.
- NISHIO, K., on history of coal-mining. 1912, i. 491.
 on history of iron. 1912, i. 510.
 on history of metal mining. 1912, i. 446.
 on mineral statistics of Japan. 1912, i. 626.
- NISHIZAWA, K., on coal in China. 1911, i. 544.
 on iron ore in China. 1911, i. 517; 1913, ii. 499.
- NITCHIE, C. C., on estimation of sulphur. 1912, ii. 623.
- NOBLE, E. E., on pulverised coal. 1920, ii. 322.
- NODEN, GEORGE, elected associate. 1917, i. 6.
- NOLAN, E. D., on expectation of oil in California. 1919, ii. 478.
- NOLD, S. E., on foundry costs. 1912, ii. 552.
- NOLLY, H. DE, on case-hardening. 1912, i. 545.
 on estimation of carbon. 1911, i. 682, ii. 656; 1912, i. 601, ii. 382.
 on gases escaping from carburisers. 1912, ii. 382.
 on magnetic properties of dynamo sheets. 1912, ii. 382.
 on microstructure of iron and steel. 1914, i. 715.
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- NOLLY, H. DE, and L. VEYRET—
Paper on "Transformations of steels." 1914, ii. 165. I. Reversible or almost reversible transformations, 165; dilatation curves of reversible carbon steels of varying degrees of hardness, 166. II. Irreversible transformations, 169; notes on the dissociation of cementite, 172.—*Correspondence*: E. D. Campbell, 180.
- NOLTE, C. B., on procuring materials for munitions 1917, ii. 428.
- NOMURA, TAKEHIKO, elected member. 1920, i. 5.
- NORBURY, A. L.—
Paper on "The effect of various elements on the electrical resistivity on iron." 1920, i. 627; summary of most important papers up to and including that of Benedicks in 1902, 627; account of recent work showing; the effect of various elements on the electrical resistivity of iron, 630; discussion of results collected in Table I, 638; the calculation of the electrical resistivity of a steel from its chemical composition, 639; summary, 643; list of references, 643.—*Correspondence*: A. McCance, 645.
Paper on "Chromium steels." See EDWARDS, C. A.
 elected member. 1921, ii. 10.
- NORDBERG, B. V., on winding-engines. 1912, ii. 512.
- NORDENFELT, AKE HJALMAR, elected member. 1912, i. 3.
- NORRIS, E. R., on tests of high-speed tools. 1911, ii. 622.

- NORRIS, G., on abrasion tests. 1918, ii. 492.
- NORRIS, G. L., on elastic limit of vanadium-chromium steels. 1915, i. 610.
 on influence of vanadium in cast iron. 1911, ii. 627.
 on occurrence of vanadium. 1911, ii. 484.
 on properties and uses of alloy steel. 1916, i. 376.
 on properties of vanadium steel. 1917, ii. 449.
 on vanadium steel for locomotive frames. 1913, ii. 647.
 on wearing properties of steel. 1913, ii. 658.
- NORRIS, R. V., on storage of coal. 1911, ii. 536.
 on valuation of coal-mines. 1917, i. 335.
- NORTH, E. D., on glass models of mine workings. 1911, i. 528.
- NORTHRUP, E. F., on effect of temperature on resistance of graphite. 1913, ii. 529.
 on electric steel furnace. 1921, i. 464.
 on properties of nichrome. 1916, ii. 458.
 on pyrometry. 1915, ii. 230; 1918, i. 481; 1919, ii. 468.
 on resistivity of refractories. 1914, i. 588.
 on use of tungsten and molybdenum for thermo-couples. 1913, ii. 533.
- NORTHRUP, H. B., on nitrogen in steel. 1921, i. 464.
- NORTHRUP, J. D., on natural-gas industry. 1916, ii. 470.
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- NORTON, G. R., on rolling of steel bars. 1921, i. 434.
- NORTON, R. H., on apparatus for carbon determination. 1918, ii. 508.
- NORTON, S., on magnetic concentration of low-grade ores. 1917, i. 290.
- NOWICKI, R., on gases in mines. 1912, i. 488.
- NOYES, W. A., JUN., on electrolytic iron. 1921, i. 470.
- NULSEN, J. C., on advances in malleable iron practice. 1915, ii. 272.
- NUSBAUM, C. A., on magnetic analysis. 1920, i. 750.
- NUSBAUMER, E.—
Paper on "Rotary bend tests, alternating bend tests and repeated shock tests." C.S.M., 1914, vi. 94; introduction, 94; historical, 96; description of apparatus and of materials investigated, 105; details of the experiments, 115; conclusions, 164.
 on bending tests. 1915, i. 602.
 on metal drawing and stamping. 1914, ii. 348.
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 on rotary bend tests. 1914, ii. 370.
 on wear of bronzes. 1912, ii. 382.
 awarded Carnegie Research Grant. 1912, i. 27.
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- NYDEGGER, O., on estimation of chromium. 1911, ii. 661.
- NYE, R. D., on electric driving of rolling-mills. 1918, i. 521.
- NYSTRÖM, E., on electric smelting of iron ore. 1912, ii. 530.

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- OAKES, FREDERICK BISMARCK, elected member. 1913, ii. 5
- OATMAN, F. W., on storage of petroleum. 1912, i. 477.
 on working petroleum. 1914, i. 613.
- OBER, W. T., on welding of rock drills. 1921, ii. 394.

- OBERFELL, G. G., on composition of natural-gas. 1915, ii. 247; 1916, i. 321.
 on conservation of natural-gas. 1915, ii. 248.
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 OBERHELMAN, G. O., on estimation of vanadium. 1915, ii. 334.
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 on chromium tungsten steels. 1921, ii. 414.
 on corrugation in tram rails. 1921, ii. 406.
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 on flaky fracture. 1920, ii. 372.
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 on inclusions in steel. 1919, ii. 523.
 on influence of annealing on steel castings. 1915, i. 587.
 on influence of forging on mild steel. 1914, i. 689.
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 on metallography. 1915, i. 620; 1921, ii. 411.
 on slag enclosures. 1914, ii. 365.
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 ODELBERG, E., on electric production of steel in Sweden. 1911, ii. 590.
 on electric smelting of pig iron in Sweden. 1911, ii. 548.
 ODELL, C. M., on methods of working coal. 1914, ii. 309.
 ÖDLUND, H. O., on use of gas in annealing furnaces. 1913, i. 645.
 O'DONAHUE, T. A., on valuation of mineral properties. 1914, i. 634.
 ODQUIST, G., on electric smelting of iron ore. 1914, i. 649; 1915, i. 554.
 on iron industry in Norway. 1918, ii. 509.
 OEBBEKE, K., on iron ore in Germany. 1915, i. 481.
 on uses of petroleum. 1911, ii. 519.
 OEHLER, E. H., on fireclay for use in the foundry. 1913, i. 528.
 OERTEL, W. W., on recrystallisation of iron. 1920, i. 757.
 OESTERHELD, G., on vacuum electric furnace. 1916, i. 347.
 OESTERLEN, OTTO, elected member. 1914, i. 3.
 OESTERREICH, M., on Helfenstein electric furnaces. 1913, i. 629.
 OETTERSON, J. E., on munitions design for quantity manufacture. 1917, ii. 428.
 OGILVIE, ALLAN, elected member. 1917, i. 3.
 OGILVIE, HARRY KINLOCH, elected member. 1920, i. 5.
 O'HEA, (MISS) AILIN M., elected member. 1918, ii. 3.
 OHNESORGE, O., on history of direct recovery process. 1913, ii. 549.
 on utilisation of coke-oven gases, 1914, i. 609.
 OHTANI, MASUZIRO, elected member. 1918, i. 4.
 OINOUE, Y., on microstructure of fired clays. 1917, ii. 351.
 OISHI, G.—
 Paper on "The properties of iron-chromium-carbon steels." See EDWARDS, C. A.
 elected member. 1917, ii. 4.

- OKNOF, M., on structure of micro-constituents of steel. 1911, i. 663 ; 1912, i. 583.
on volume changes of quenched steel. 1914, i. 715 ; 1918, i. 554.
- OKOOHI, VISCOUNT M., on erosion of guns. 1920, ii. 393.
on growth of cast iron. 1920, ii. 379.
on heat conductivity of moulding sand. 1917, ii. 397.
on molybdenum steel for guns. 1919, ii. 508.
elected member. 1919, ii. 4.
- OKURA, Y., on magnetic and electric properties of iron and steel. 1914, ii. 375.
- OLCOTT, F. J., on heat-treatment of chrome-nickel steels. 1921, i. 441.
- OLDFATHER, W. A., on definition of term "ceramics." 1921, i. 379.
- OLIN, H. L., on coking at low temperatures. 1915, ii. 235.
on coking tests of coal. 1913, i. 545.
- OLIVEIRA, E. P. DE, on petroleum in Brazil. 1921, ii. 355.
- OLIVER, E., on appraisal of oil properties. 1920, ii. 339.
- OLLANDER, O., on alcohol recovery from coke-oven gas. 1920, i. 697.
on electrostatic deposition of fine-dust. 1921, i. 404.
- OLLARD, ERIC ALEXANDER, elected member. 1920, ii. 5.
- OLMSTEAD, G. C., on concentration of iron ore. 1913, i. 523.
- OLSEN, J. C., on case-hardening. 1913, i. 644.
- OLSEN, T. Y., on testing machines. 1915, i. 604 ; 1921, i. 452, ii. 397.
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- OLSON, SVEN RAGNAR, elected member. 1921, i. 4.
- OLSSON, HENNING A., elected member. 1914, ii. xx.
- OLSSON, IVAR, elected member. 1912, i. 3.
- OLSZEWSKI, S., on petroleum in Austria. 1913, i. 551.
- O'NEILL, H., on measurements of hardness. 1920, ii. 380.
on mechanical properties of steels. 1921, ii. 399.
elected associate. 1917, i. 6.
transferred to membership. 1921, i. 6.
- ONIONS, R., on modern iron founding. 1916, i. 559.
- ONNES, K., on magnetic properties of alloys. 1921, ii. 408.
- OPPEN, E., on recovery of scrap iron from sand in foundries. 1915, i. 566.
- OPPENHEIMER, F., on design of microscopes. 1921, ii. 414.
- ORDONEZ, E., on origin of petroleum. 1915, i. 519.
- ORDONEZ, SALVADOR DIAZ, obituary notice of. 1912, i. 414.
- ORELKIN, B., on colorimetric method for the determination of iron. 1915, i. 633.
- ORGAN, J. M., on expansion of firebricks. 1912, i. 455.
- ORLANDO, GUISEPPE, elected member. 1917, i. 3.
- ORSETTICH, R., on electricity in American steelworks. 1921, i. 432.
elected member. 1920, ii. 5.
- ORTHEY, M., on composition of fire-bricks. 1911, ii. 497.
on estimation of carbon in nickel. 1912, ii. 619.
- ORTMANN, H., on heat-consumption of gas-engines. 1914, i. 621.
- ORTMANN, RUDOLPH, elected member. 1912, i. 3.
- ORTON, B., on iron ore in Cuba. 1912, ii. 453 ; 1915, i. 486.
on iron ore handling. 1915, i. 494.
on manganese ore in Cuba. 1915, i. 489.
- OSANN, B., on blast-furnace reactions. 1912, i. 495 ; ii. 521.
on calculation of blast volume and composition blast-furnace gas. 1917, ii. 391.

- OSANN, B., on concentration of iron ore and flue-dust. 1913, ii. 521.
 on cupola practice. 1911, i. 592.
 on desulphurisation in converter. 1919, ii. 496.
 on desulphurising process of basic pig iron. 1914, i. 723.
 on drying stoves. 1911, ii. 569.
 on heat balance of blast-furnace. 1916, ii. 417.
 on hot-blast stoves. 1915, i. 551.
 on imperfect castings. 1912, i. 522.
 on methods of calculating blast-furnace charges. 1915, i. 545.
 on piping in steel ingots. 1911, ii. 609.
 on pressure segregation in castings. 1920, i. 711.
 on stresses in iron and steel. 1914, i. 714.
 on sulphur in blast-furnace. 1916, i. 329.
 on temperature of waste gases in the foundry. 1918, i. 501.
- OSBON, C. C., on peat in United States. 1920, i. 693.
- OSBORN, H. B., on tungsten ore in Burma. 1914, i. 577.
- OSBORN, JOHN ARTHUR, elected member. 1919, ii. 4.
- OSBORNE, C. G., on electric furnaces of special types. 1911, i. 621.
 elected member. 1912, ii. 6.
- OSBORNE, N. S., on an aneroid calorimeter. 1915, i. 503.
- OSBORNE, W. F., on lubrication of gears and pinions. 1921, ii. 382.
- OSCHMANN, W., on conduction-motor for continuous rolling-mill. 1914, ii. 346.
- OSER, JOHANN, obituary notice of. 1913, i. 490.
- OSGOOD, F. D., on analyses of Iowa coals. 1921, ii. 349.
- O'SHEA, L. T., on coke manufacture. 1911, i. 549.
 on coking industry in South Yorkshire and Derbyshire. 1911, ii. 512.
 on explosions in collieries. 1915, i. 538.
 on history of the safety-lamp. 1916, ii. 412.
- OSMOND, FLORIS, on ancient iron and steel. 1912, i. 159.
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 on magnetic properties of iron alloys. 1911, i. 658.
 on transformations of iron and steel. C.S.M., 1911, iii. 214.
 on transformation of steel during heat-treatment. 1911, ii. 60.
 obituary notice of. 1912, i. 415.
- OSSWALD, F., on safety appliances for cupolas. 1914, i. 657.
- OSTRAND, P. M., on manganiferous ore in the United States. 1918, ii. 432.
- OSTWALD, H., on forging. 1912, i. 551.
 on magnetic separation of iron ore. 1911, i. 532.
- OTIN, C. N., on estimation of manganese. 1911, i. 684.
- O'TOOLE, E., on dry-cleaning of coal. 1921, i. 399.
- OTTE, on haulage in collieries. 1912, i. 487.
- OTTEN, H., on mine supports. 1915, i. 531.
- OTTERSON, J. E., on manufacture of chain cables. 1917, i. 386.
- OTTO, C., on heat-balance of coke-ovens. 1915, ii. 235.
- OTTO, C. A., on method of moulding a suction chamber. 1913, i. 612.
- OULHAYE, M. M. D', on iron ore dressing. 1911, i. 530.
- OURBACKER, S. H., on Weeks' electric furnace. 1921, i. 426.
- OUSTON, WILLIAM HENRY, elected member. 1921, ii. 11.
- OUTERBRIDGE, A. E., JUN., on ferro-alloys in foundry work. 1917, ii. 397.
 on foundry cores. 1912, i. 520.

- OUTERBRIDGE, A. E., JUN., on influence of manganese and silicon on foundry iron. 1911, ii. 561.
 on machinable castings from permanent moulds. 1917, ii. 399.
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- OVANS, CHARLES PHIPPS JOHN, elected member. 1920, i. 5.
- OVERBECK, R. M., on nickel in Alaska. 1921, i. 375.
- OVING, HERMAN ELLENS, JUN., elected member. 1919, i. 5.
- OVITZ, F. K., on ammonia in producer-gas. 1920, i. 702.
 on analysis of flue-gases. 1916, i. 402.
 on characteristics of American coals in coking practice. 1918, ii. 453.
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- OWEN, ALFRED ERNEST, elected member. 1917, ii. 4.
- OWEN, GEORGE WILLIAM, elected member. 1915, i. 2.
- OWENS, J. S., on measurement of density of smoke. 1912, i. 461.
 on smoke abatement. 1912, ii. 477.
- OXLEY, A. E., on allotropy of iron. 1915, ii. 321; 1916, i. 388.

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- PACCHIONI, A., on producer-gas from lignites. 1917, ii. 379.
- PACHER, F., on ingots for forgings. 1921, ii. 379.
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- PACK, C., on die castings. 1918, ii. 469; 1919, ii. 491; 1920, ii. 352.
- PACK, R. W., on coal in the United States. 1915, ii. 234
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- PADGETT, F. W., on chemistry of petroleum. 1921, ii. 356.
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- PAEHR, on haulage in collieries. 1912, i. 487.
- PAGDIN, JOHN HALLSWORTH, elected member. 1921, i. 4.
- PAGE, ARTHUR REGINALD, elected associate. 1918, i. 7.
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- PAGE, E. P., on classification of refractory materials. 1917, i. 292.
- PAGLIANTI, P., on influence of silicon on the properties of mild steel. 1912, ii. 585.
 on roll-draughting. 1912, ii. 570.
- PAIGE, A. E., on properties and uses of alloy steels. 1916, ii. 453.
- PAIGE, JOHN FRIEND, elected member. 1921, ii. 11.
- PAIGE, S., on iron ores of Alsace-Lorraine. 1919, i. 618.
 on iron ore in the United States. 1911, i. 521, ii. 478.
- PAILLARD, L., on hydrocarbons. 1920, i. 698.
- PAIN, A. A., on corrosion of iron. 1920, i. 761.
 on corrosion of metals by acids. 1919, i. 698.
- PAINE, P. M., on working petroleum. 1913, ii. 554.
- PALIAKOFF, R., on high-speed tool steel tests. 1916, ii. 457.
- PALLISTER, H. D., on mine surveying. 1916, i. 299.
- PALMAER, W., on electrolytic deposition of iron. 1913, ii. 679.

- PALMENBERG, O. W., on calorimetry. 1911, i. 537.
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- PALMER, ALBERT EDWARD, elected member. 1920, ii. 5.
- PALMER, C. S., on producer-gas. 1918, ii. 459.
- PALMER, L. A., on coal-fields of Montana. 1914, ii. 290.
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- PALMER, R. C., on hardwood distillation industry on Pacific Coast. 1916, i. 512.
- PALMER, R. H., on cupola practice. 1911, ii. 559.
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- PANEK, E., on coal in Austria. 1911, ii. 507; 1912, i. 463.
- PANNELL, J. R., on fatigue of welded joints. 1912, i. 563.
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- PANYITY, L. S., on natural-gas in Ohio. 1918, ii. 458.
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- PAPE, M., on means of transport in foundry practice. 1913, i. 615.
- PAPE, P., on blast-furnace stoves. 1916, i. 332.
- PAQUET, J., on measurement of gases in iron. 1915, i. 619; 1916, ii. 433.
- PARDÉE, J. T., on coal in Montana. 1914, i. 602.
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- PARIS, G., on corrosion in steam boilers. 1921, i. 469.
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- PARISH, H. C., on speeding up metallurgical analyses. 1919, i. 701.
- PARK, SIDNEY RICHMOND, elected member. 1916, i. 3.
- PARKER, on metallic filings. 1914, ii. 368.
- PARKER, CHARLES HENRY, elected member. 1917, ii. 4.
- PARKER, E. W., on briquetting coal. 1916, ii. 414.
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on production of coke in the United States. 1912, i. 630.
on statistics of coal-briquetting in United States. 1914, ii. 404.
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- PARKER, GEORGE VERNON, elected member. 1921, i. 4.
- PARKER, J., on hardening of steel. 1914, i. 696.
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- PARKER, J. H., on heat-treatment for case-hardened gears. 1915, i. 587.
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- PARKER, JAMES HEBER, elected member. 1912, i. 3.
- PARKER, JAMES HENRY, elected member. 1918, i. 4.
- PARKER, S. W., on properties and structure of nickel steel. 1917, ii. 448.
- PARKER, W. B., on classification of foundry iron. 1914, i. 658.
on specifications for foundry pig irons. 1913, i. 595.
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- PARKER, WILLIAM EDWIN, elected member. 1917, i. 3.
- PARKHURST, F. A., on foundry economics. 1915, i. 567.
- PARKHURST, L. P., on influence of annealing on electric properties of hardened steel. 1918, ii. 485.
- PARKIN, ARTHUR MERVYN, elected member. 1920, ii. 6.
- PARKIN, ERNEST, elected member. 1916, i. 3.
- PARKIN, F. M., on welding-up of blowholes in steel. 1911, i. 88.
- PARKS, H. M., on manganese ore in the United States. 1919, i. 621.
- PARKYN, WILLIAM THOMAS, elected member. 1921, i. 4.
- PARMELEE, H. C., on concentration of tungsten ores. 1916, i. 300.
- PARODI, L., on nickel in Italy. 1917, i. 287.
- PARR, S. W., on alloy for calorimetric bombs. 1916, i. 305.
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on coal analysis. 1915, i. 635.
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- PARRAVANO, N., on properties of ternary and quaternary alloys. 1913, i. 673,
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- PARRY, D. E., on winding equipment. 1911, i. 568.
- PARRY, JOHN, obituary notice of. 1915, i. 464.
- PARSONS, A. D. C., on foundry economics. 1917, i. 360.
- PARSONS, A. L., on molybdenite in Ontario. 1917, ii. 343.
- PARSONS, SIR CHARLES, on formation of diamond. 1918, ii. 505.
- PARSONS, C. L., on manufacture of uranium oxide. 1917, ii. 452.
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- PARSONS, C. S., on iron-ore washing. 1914, i. 585.
- PARSONS, F. R., on gas-producers. 1914, ii. 304.
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- PARSONS, F. W., on coal in the United States. 1911, i. 547.
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- PARSONS, J. A., on cupola practice. 1916, ii. 422.
- PARSONS, R. H., on safety in sand-blasting. 1915, i. 566.
- PASCAL, P., on densities of metals. 1914, ii. 383.
- PASCOE, CHARLES FREDERICK, elected member. 1916, i. 4.
- PASCOE, E. H., on coal in India. 1912, i. 465.
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- PASHLEY, JOSEPH, elected member. 1918, i. 4.
- PASLEY, ERNEST, elected associate. 1917, i. 6.
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- PASQUIER, A. C DU, on winding. 1912, ii. 512; 1917, ii. 384.
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- PASSON, H., on slag cement. 1912, i. 511.
- PATCH, E. L., on heat-treatment of chain cables. 1917, i. 385.
- PATCHELL, W. H., on fuel economy. 1919, ii. 113.
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- PATERSON, C. C., on pyrometry. 1915, i. 504.
- PATERSON, J. H., on electric welding. 1919, ii. 513.
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- PATON, A., on roll scale in Bessemer practice. 1917, i. 363.
- PATON, D., on coke-oven practice. 1919, i. 640.
- PATON, JAMES, elected member. 1912, i. 4.
- PATON, J. D., on briquetting coals. 1917, i. 336.
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on hydraulic stowing. 1914, i. 625; 1915, i. 534.
- PATON, JAMES HISLOP, elected member. 1918, i. 4.
- PATRICK, W. A., on estimation of oxygen in iron. 1912, ii. 621; 1913, ii. 698.
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- PATRZEK, J., on coal in Poland. 1919, i. 639.
- PATTEN, GEORGE DAWSON, elected member. 1913, i. 3.
- PATTEN, R., on patterns and moulding. 1912, ii. 544.
- PATTERSON, STANLEY R., elected member. 1919, ii. 4.
- PATTERSON, W. HAMILTON—
Paper on "An examination of fire-bricks and some other technical refractory materials." *C.S.M.*, 1914, vi. 231; chemical analyses, 232; limit of refractoriness, 235; measurement of temperatures, 236.
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- PATTINSON, JOHN, obituary notice of. 1912, i. 417.
- PATZUKOFF, N., on estimation of carbon in ferro-chromium. 1912, i. 608.
- PAUL, F. W.—
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- PAUL, J., on winding appliances. 1912, i. 487.
- PAUL, J. W., on rescue appliances. 1911, ii. 535; 1913, i. 576; 1917, i. 335.
- PAUL, MARCEL, elected member. 1921, i. 4.
- PAULL, F. M., on rotary reheating furnace. 1916, i. 358.
- PAULL, W. T., on foundry of Cerro de Pasco Mining Co. 1911, ii. 572.
- PAULMANN, on Strenge peat-cutting machine. 1911, ii. 511.
- PAULY, K. A., on electric reversing mills. 1921, i. 433.
on rating of rolling-mill motors. 1919, i. 670.
on speed control of rolling-mills. 1921, ii. 380.
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- PAUNESCU, J., on manganese carbides. 1914, ii. 383.
- PAUSERT, T., on rolling-mill at Terni. 1912, ii. 571.
- PAVLOFF, M. A., on dimensions of open-hearth furnaces. 1911, ii. 582.
- PAYNE, C. Q., on concentration of iron ores. 1913, i. 523.
- PAYNE, H. B., on welding of structural work. 1921, i. 445.
- PAYNE, H. M., on iron ore handling. 1912, ii. 462.
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- PAYTON, JOSEPH, elected member. 1921, ii. 11.
- PEAKMAN, PERCY, elected member. 1919, i. 5.
- PEASE, CYRIL, elected member. 1920, ii. 5.
- PEASE, O. D. A., on heat-treatment of steel castings. 1914, i. 694.
- PEAT, SIR W. B., speech at dinner by. 1912, i. 401.
- PEAT, W. M., on equipment of collieries. 1913, ii. 565.
- PECK, E. C., on tests on high-speed tool steel. 1911, i. 653.
- PECK, W. R., on coal in the United States. 1915, ii. 234.
- PECORARO, N., on researches on white metals. 1912, ii. 382.
- PEEBLES, C. R., on blast-furnace capacities. 1921, ii. 363.
- PEECH, ALBERT ORLANDO, elected member. 1918, i. 4.
- PEECH, JAMES EDWARD, elected member. 1918, i. 4.
- PEERS, J., on faulty castings. 1916, i. 342.
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- PEFFER, E. L., on standard tables for petroleum oils. 1917, i. 325.
- PEGG, H. V., on power from peat-gas. 1912, ii. 505.
- PEILE, HENRY, elected member. 1911, ii. 10.
- PEIPER, on winding equipment. 1911, i. 568.
- PEIPERS, C., on turning steel ingots to remove surface flaws. 1912, i. 551.
- PERSE, TOM, elected member. 1917, ii. 4.
- PELLETT, J. S., on magnetic separation. 1914, ii. 277.
- PELLEW, C. E., on ferro-silicon. 1914, ii. 385.
- PELLISSIER, G. E., on corrugation of rails. 1912, i. 573.
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- PEMBERTON, H., on cupola practice. 1912, ii. 539.
- PENDER, H., on heat-treatment of steel. 1913, ii. 641.
- PENDRED, LOUGHNAN, elected member. 1913, i. 3.
- PENDRED, VAUGHAN, obituary notice of. 1912, ii. 434.
- PENKIEWITSCH, B., on formation of manganese sulphide. 1914, i. 730.
- PENZER, N. M., on coal in Anatolia. 1920, i. 693.
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- PEPPER, C. M., on petroleum in Peru. 1914, i. 612.
- PEPPERBERG, L. J., on coal in Montana. 1912, ii. 486.
- PERCY, P. C., on peat-gas producers. 1912, i. 483.
- PERDRIZET, I. D. N., on Kestner's apparatus. 1921, i. 469.
- PERIN, C. P., on ironworks in India. 1912, i. 504; 1921, i. 407.
- PERKIN, F. M., on oil resources of British Empire. 1914, ii. 406.
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- PERKINS, F. C., on coal-cutting machinery. 1912, i. 486.

- PERKINS, F. C., on coal-handling. 1911, i. 578.
on electric production of steel. 1911, i. 624; 1912, i. 540.
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- PERKINS, F. M., on electrolytic deposition of metals. 1911, i. 671.
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- PERKINS, W. H., on porosity of iron. 1914, i. 737.
- PERLEWITZ, K., on an electric testing machine. 1912, i. 568.
- PERO, J. P., on malleable cast iron. 1914, ii. 332; 1915, ii. 272.
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- PERRENET, L., on manufacture of artificial asphalt. 1912, i. 477.
- PERRETT, LAURENCE ARTHUR STEEL, elected member. 1920, i. 6.
- PERRINE, H., on strength of iron at varying temperatures. 1915, i. 601.
- PERROT, C. St. J., on coal-cleaning. 1921, ii. 359.
- PERRY, C. C., on German cartel system. 1917, i. 426.
- PERRY, L. P., on iron wire for electric transmission. 1918, i. 549.
- PERSOZ, L., on testing of sheets by perforation. 1911, ii. 616.
- PERTUSI, C., on estimation of silicon in ferro-silicon. 1912, ii. 619.
- PETAVEL, J. E., on efficiency of gas-engines. 1915, ii. 252.
- PETER, A. M., on iron ore in Kentucky. 1914, ii. 268.
- PETER, F., on utilisation of waste heat of furnaces. 1912, ii. 525.
- PETER, J. F., on Cumberland electrolytic method. 1916, i. 397.
- PETERS, E. W., on mine supports. 1912, ii. 508.
- PETERS, F., on electro-metallurgy of alloys. 1916, ii. 430; 1920, ii. 360;
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on electro-metallurgy of aluminium. 1916, i. 390.
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- PETERS, MAURICE, obituary notice of. 1914, i. 554.
- PETERS, R., JUN., on American blast-furnace. 1921, ii. 361.
- PETERSEN, O., on open-hearth process. 1911, i. 618.
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- PETERSON, A. W., on sand-blasting of forgings. 1918, i. 519.
- PETERSON, G., on heat-treatment of die-blocks. 1918, ii. 485.
- PETERSON, W. C., on case-hardening. 1918, ii. 481.
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- PETINOT, N., on manufacture of alloy steels. 1915, i. 610.
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- PETIT, A., on winding appliances. 1913, i. 574.
PETRASCHECK, W., on deep boring. 1914, i. 580.
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PETRE, R. W., on manganese ore in the United States. 1916, ii. 379.
PETRIE, W. M., on ancient metallurgy of iron and steel in Egypt. 1912, i. 182.
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PETTIGREW, JOHN, elected member. 1912, i. 4.
PETTIJOHN, E., on estimation of oxygen in iron and steel. 1919, i. 700.
PEUKERT, W., on electric conductors. 1916, ii. 459.
PEYTON, J. I., on the duplex process. 1915, ii. 276.
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PFLEIDERER, G., on formation of rust under paint. 1913, ii. 691.
PFOSE, A., on heating blast-furnace stoves. 1917, ii. 391.
PHALEN, W. C., on bauxite industry of United States. 1912, ii. 467, 642;
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 on coal in the United States. 1911, ii. 510.
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 on use of bauxite bricks for furnace linings. 1917, i. 301.
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PHELPS, H. M., on methods of working in collieries. 1911, ii. 530.
PHILIP, A., on corrosion of iron and alloys. 1916, i. 391.
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PHILLIP, on manganese ore in Hungary. 1920, i. 672.
PHILLIPON, on manufacture of silica bricks. 1918, ii. 446; 1919, i. 630.
- PHILLIPS, CHARLES DAVID, obituary notice of. 1912, ii. 434.
PHILLIPS, GEORGE, elected member. 1913, ii. 5.
PHILLIPS, H., on estimation of phosphorus. 1914, i. 742.
PHILLIPS, H. J., on estimation of sulphur. 1919, i. 701.
PHILLIPS, W. B., on American blast-furnace. 1912, ii. 527.
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 on development of Appalachian, Lima, and Texas oil-fields. 1912, ii. 642.
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PHILP, C. VON, on special forging press. 1914, ii. 345.
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- PHILLY, on coal-handling. 1913, ii. 574.
- PICARD, H. K., on preparation of ores for analysis. 1912, ii. 622.
- PICARD, M., on composition of tars. 1921, ii. 353.
- PICARELLI, A., on hardness testing. 1918, ii. 491.
- PICK, W., on manufacture of ferro-silicon in the electric furnace. 1912, ii. 561.
- PICKARD, J. A.—
Paper on "The estimation of oxygen in iron and steel." C.S.M., 1913, v. 70; introduction, 70; previous methods for the estimation of oxygen, 73; outline of the present investigation, 77; details of the method used, 77; experimental results, 81; summary, 85.
Paper: "The oxygen content of iron and steel and its effect on their properties." C.S.M., 1916, vii. 68.
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awarded Carnegie Research Grant. 1912, i. 27; 1914, i. 24.
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- PICKARD, J. A., and F. M. POTTER—
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- PICKERSGILL, W., on winding plant for iron mines. 1915, i. 493.
- PICKETT, F. N., on development in lifting magnets. 1920, ii. 361.
- PICKUP, G. E., on melting shot iron in the cupola. 1915, i. 559.
- PICOT, A., on low-temperature distillation of coal. 1917, i. 314.
- PIERCE, R. H. H., on manufacture of fire-bricks. 1917, i. 297.
- PIERCE, T. E., on by-product recovery. 1920, ii. 329.
- PIERRE, E., on reactions in the blast-furnace. 1921, i. 402.
- PIETERS, J., on coke-oven practice. 1916, ii. 399.
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- PIETKOWSKI, A., on coal transport in Italy. 1913, ii. 574.
- PIGOTT, L. J. S., on utilisation of low-grade fuels. 1918, i. 480.
- PIGOTT, W., on blast-furnaces in China. 1920, ii. 349.
- PILKINGTON, C., on shaft-sinking. 1915, i. 530.
- PILKINGTON, H., on "artificial" pig iron. 1911, ii. 561.
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- PILKINGTON, T., on welding tips on cutting tools. 1916, ii. 445.
- PILLING, H., on rolling-mill engines. 1911, i. 608.
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- PILLING, N. B., on cooling properties of quenching liquids. 1920, i. 731.
- PILNACEK, E. A., on flash annealing large projectiles. 1917, ii. 423.
- PILON, H., on radiography of metals. 1916, ii. 462.
- PILZ, R., on manganese ore in Spain. 1915, i. 488.

- PINA DE RUBIES, D. S., on estimation of iron in chromite. 1913, i. 693.
- PINOT, R., on French iron and steel industry. 1919, ii. 543.
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- PIRANI, M. VON, on melting points of metals. 1912, ii. 607; 1920, i. 756.
- PIRIE, W., on mine surveying. 1912, i. 491.
- PISHEL, M. A., on testing coke. 1913, ii. 544.
- PITAVAL, ROBERT, elected member. 1914, ii. xx.
- PITT, HAROLD RUSSELL, elected member. 1918, i. 4.
- PIWOWARSKY, E., on gases in pig iron. 1921, i. 403.
 on influence of elements on cast iron. 1920, ii. 380.
- PLANELL Y RIERA, JOAQUIN, elected member. 1921, i. 4.
- PLANK, R., on contraction coefficient of iron at great elongations. 1911, ii. 615.
 on heating of metals under test. 1911, i. 647.
 on impact tensile tests. 1912, ii. 590.
- PLATZMANN, C. R., on uses of blast-furnace slag. 1921, ii. 367.
- PLETSCH, L., on sheet-iron manufacture in South Russia. 1919, i. 671.
 elected member. 1912, i. 4.
- PLIENIGER, R., on oxy-acetylene welding process. 1914, i. 697; 1915, ii. 297.
- PLOCK, A. F., on sintering and briquetting of iron ores. 1913, ii. 523.
- PLOEHN, J. H., on use of oil-fired furnaces for foundries. 1913, i. 611.
- PLUMLEY, M. S., on oxy acetylene welding and cutting. 1913, i. 649; 1918, i. 528; 1920, ii. 377.
- PLUMMER, JAMES HENRY, elected member. 1914, ii. xx.
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- POCOCK, R. W., on fluorspar. 1917, ii. 405.
- PODSZUO, E., on manufacture of zirconia apparatus. 1918, i. 556.
- POETTER, HEINRICH, elected member. 1911, ii. 10.
- POETZSCH, W. G., on the Barth gas-producer. 1916, i. 323.
- POGUE, J. E., on form value of energy. 1921, i. 381.
- POHL, HERMANN, elected member. 1913, i. 3.
- POIRET, H., on winding appliances. 1914, i. 626.
- POKORNY, on manufacture of molybdenum steel. 1921, i. 422.
- POKORNY, R., on cleaning of blast-furnace gases. 1911, ii. 545.
- POKORNY, W., on rescue appliances in Austrian coal-mines. 1913, ii. 572.
- POLIAKOFF, R., on durability tests of high-speed steels. 1919, ii. 519.
 on specifications for high-speed tool steels. 1915, i. 606; 1919, ii. 527
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- POLLAK, J., on heat-treatment of hollow steel axles. 1918, i. 527.
- POLLARD, A. L., on cupola practice. 1915, ii. 268.
 on properties of malleable cast-iron in relation to composition. 1914, ii. 364.
- POLLARD, J. A., on use of mud-laden fluid in oil boring. 1914, ii. 301.
- POLLARD, REGINALD DOWNES, elected associate. 1920, i. 7.
- POLLARD, W., on coal in the United Kingdom. 1915, ii. 233.
- POLLOCK THOMAS, elected member. 1917, ii. 4.
- POLSTER, on coal briquettes. 1912, i. 493.
- POLUSEKIN, E. P.—
Paper on "Alloys of iron and uranium." C.S.M., 1920, x. 129.
 on chilled cast-iron wheels. 1921, i. 415.

- POLUSHKIN, E. P., elected member, 1921, i. 4.
- POMERANTZEFF, B., on utilisation of waste heat in ironworks. 1911, i. 540.
- POMEROY, R. E. H., on pulverised coal. 1920, ii. 322.
- POMMER, on coal-haulage in Dortmund mining district. 1913, ii. 567.
- POMP, A., on crushing resistance of steel. 1921, i. 457.
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- PONCELET, on iron ore in Algeria. 1911, i. 518.
- PONGRACZ, A., on reactions in blast-furnace equilibrium. 1920, ii. 343.
- PONTE, G., on oil shale in Sicily. 1915, i. 520.
- PONTHIERE, HONORÉ, reference to death of. 1914, ii. 257.
- POOLE, on iron and steel in South Africa. 1921, ii. 365.
- POOLE, C. R., on heat-treatment of motor parts. 1918, ii. 485.
- POOLE, G., on winding appliances. 1911, ii. 536.
- POOLE, G. G. T., on winding-engines. 1915, i. 536.
- POOLE, W., on cement from blast-furnace slag. 1919, ii. 489.
- POOLE, WILLIAM HENRY, elected member. 1918, i. 4.
- POPE, G. S., on sampling and analysis of fuel. 1913, ii. 708; 1917, i. 305, ii. 364.
- POPE, H. F., on manufacture of malleable cast iron. 1918, i. 502.
- POPE, S., obituary notice of. 1911, i. 500.
- POPOFF, S., on iron ore in Russia. 1914, i. 571.
- POPP, M., on analysis of basic slag. 1914, ii. 395.
- POPPENBERG, O., on explosives. 1911, i. 526.
- POPPER, J., on improvements in oxygen breathing apparatus. 1913, ii. 572.
- POPPELTON, C. F., on galvanising and tinning. 1918, i. 520, ii. 507; 1921, i. 449.
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- POPPELWELL, W. C., on alternating stress tests of steel. 1917, i. 401.
 on endurance tests. 1915, i. 602; 1917, ii. 437.
 on tests on reinforced concrete. 1912, i. 565.
- PORAT, H. VON, on use of peat-dust for locomotive fuel. 1913, ii. 543.
- PORTEOUS, G., on open-hearth steel for chisels. 1921, ii. 389.
- PORTER, A. W., on occlusion of gases in metals. 1919, i. 689.
- PORTER, C. B., on standardisation of die-blocks. 1920, ii. 366.
- PORTER, C. T., on relation between tensile strength and hardness. 1915, i. 597.
- PORTER, G., on use of tar-oil fuel in Diesel engines. 1918, ii. 458.
- PORTER, H. C., coal and coke by-products as sources of fixed nitrogen. 1917, i. 316.
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- PORTER, H. C., on spontaneous heating of coal. 1918, ii. 451.
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 on weathering of Pittsburgh coal. 1914, ii. 314.
- PORTER, H. F., on a new form of pyrometer. 1920, i. 687.
- PORTER, J. B., on coal in Canada. 1912, ii. 483; 1917, i. 312.
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- PORTER, J. J., on blast-furnace practice. 1912, i. 496; 1913, i. 590, ii. 577.
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 on influence of various elements on the properties of cast iron. 1911, i. 643; 1912, i. 556.
 on iron ore in the United States. 1911, i. 519; 1912, ii. 452.
 on specifications for machinery castings. 1913, i. 668.
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- PORTER, J. M., on laboratories. 1911, i. 680.
- PORTEVIN, A. M.—
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Paper on "The thermo-electric properties of special steels." See DUPUY, E. L.
 on anisotropy of coarse-grained metals and alloys. 1915, ii. 321.
 on carburisation of iron by alkaline cyanides. 1917, ii. 421.
 on case-hardening. 1911, i. 629; 1913, ii. 637; 1914, ii. 353.
 on chemical investigation of alloys. 1913, i. 674.
 on coefficient of flow. 1913, ii. 607.
 on cooling curves of quenched metals. 1918, i. 554.
 on critical points in chromium steel. 1912, i. 584.
 on critical points of electrolytic iron. 1913, i. 677.
 on determination of critical points. 1919, ii. 528.
 on elastic limit of alloys. 1913, ii. 653.
 on electrical resistance of nickel steels. 1921, i. 463.
 on estimation of carbon by micrographical methods. 1917, ii. 462.
 on fragility in a medium-hard steel forging. 1915, ii. 312.
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 on heat-treatment of chromium steels. 1911, ii. 601.
 on heat-treatment of manganese steels. 1917, ii. 423.
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PORTEVIN, A. M., on influence on mechanical properties of time of heating prior to quenching. 1917, i. 397.

on influence of rate of cooling on hardening. 1920, ii. 372.

on influence of rate of cooling on transformation points. 1917, ii. 422.

on influence of various metals on thermo-electric properties of iron-carbon alloys. 1914, i. 714.

on internal stresses in steel. 1919, i. 685.

on iron-antimony alloys. 1911, ii. 624.

on iron-chromium alloys. 1911, ii. 625.

on macrostructure of steel. 1918, ii. 483.

on metallographical appliances. 1911, i. 661.

on microstructure of iron and steel. 1914, i. 715.

on Neumann lines. 1914, ii. 380.

on phenomena of hardening. 1921, ii. 400.

on properties of alloys. 1913, ii. 666.

on pseudo-binary alloys. 1911, i. 670.

on quenching of steel. 1920, i. 732.

on slow cooling for micrographical study of alloys. 1921, ii. 411.

on speed of transformation of steels. 1914, ii. 377.

on structure of nickel-chromium steels. 1914, i. 720.

on thermo-electric properties of iron-nickel-carbon alloys. 1913, i. 670.

on transformation of impact energy into heat in shock-testing. 1915, i. 603.

on transformation points in nickel-chromium steels. 1918, i. 550.

on wear of bronzes. 1912, ii. 382.

on Widmanstätten structure and its influence on physical properties. 1912, ii. 603.

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Paper on "The influence of coalescence on the mechanical properties of steel and on alloys." 1914, ii. 204; coalescence in bronzes, 204; coalescence in steels, 205.—*Correspondence*: L. H. Fry, 211.

Paper on "Contributions to the study of coalescence in steels and its commercial results." 1921, ii. 145; Part I. Factors influencing the phenomena of coalescence, 145. Part II. Influence of the coalescence of cementite on the properties and heat-treatment of hypereutectic steels, 158; conclusion, 176.—*Correspondence*: 138.

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POTHMANN, W., on exploitation of Brazilian iron ore. 1920, i. 671.

POTO, F. B., on inclusions in steel. 1919, ii. 522.

POTTER, W. S., on physical properties and microstructure of manganese steel. 1914, i. 717.

on rail failures. 1912, ii. 594.

POUILLOUX, A., on influence of size and working of ingot on qualities of steel. 1919, ii. 520.

POUPLIN, G., on moulding sand. 1921, ii. 371.

POURCEL, A., on influence of manganese and carbon on corrosion of steel. 1916, i. 75.

on influence of nitrogen on iron and steel. 1915, ii. 105.

POVARNIN, G., on chemical laboratory appliances. 1915, ii. 333.

POWELL, A. L., on lighting of rolling-mills. 1918, i. 522.

POWELL, A. R.—

Paper on "The determination of cobalt and nickel in cobalt steel."

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on determination of sulphur in coal. 1921, i. 473, ii. 421.

on determination of nickel and cobalt. 1917, ii. 468.

on sulphur in coal. 1920, i. 691.

on sulphur in the coking process. 1921, i. 387.

POWELL, C. W. R., on corrosion of iron. 1914, i. 734.

POWELL, E. J., on preparation of anthracite coal. 1916, i. 327.

POWELL, J. W., on methods of working coal. 1912, ii. 511.

POWELL, L. B., on manufacture of chains. 1914, i. 698.

POWELL, THEODORE, elected member. 1920, ii. 5.

POWER, A. E., on influence of temperature on hysteresis loss in iron. 1912, ii. 599.

POYNTING, J. H., on changes in dimensions of steel wire when twisted. 1912, i. 567.

POZZI-ESCOT, E., on estimation of manganese. 1913, i. 693.

PRADEL, on gas-firing devices for boilers. 1917, i. 307.

on utilisation of tar oil as boiler fuel. 1913, i. 558.

PRADEL, R., on new type of moulding machine. 1915, i. 565.

PRAKKEN, H., on foundry equipment. 1911, ii. 562.

PRANDTL, W., on estimation of vanadium. 1911, i. 688.

on preparation of vanadium. 1913, i. 694.

PRATT, A. D., on utilisation of waste heat from melting furnaces. 1917, i. 364, ii. 415; 1918, i. 501; 1920, i. 722.

PRATT, A. E., on open-hearth furnaces. 1913, i. 211.

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PRATT, HUGH, elected member. 1920, ii. 5.

- PRATT, JOSEPH FRANCIS, elected associate. 1918, i. 7.
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- PRATT, W. E., on iron ore in the Philippines. 1915, i. 482; 1916, i. 290, 291.
- PREUSS, S., on metallographical appliances. 1911, i. 661.
- PREISINGER, J., on estimation of phosphorus in iron. 1913, ii. 700.
- PREISWERK, H., on petroleum in Roumania. 1912, ii. 495.
- PRELLER, I., on analysis of burnt magnesite. 1912, ii. 471.
- PRENTISS, F. L., on blast-furnaces in America. 1920, i. 707.
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on ore storage at blast-furnaces. 1919, i. 651.
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- PRENTISS, G. L., on Egler open-hearth furnace. 1921, ii. 374.
- PRESSELL, G. V., on comparative value of quenching oils. 1918, ii. 482.
- PREST, J. J., on equipment of collieries. 1914, i. 623.
- PRESTON, A. C., on flow of oil in pipes. 1921, i. 393.
- PRESTON, F. W., obituary notice of. 1914, i. 555.
- PRESTON, GEORGE F.—
Paper: "Practical notes on the design and treatment of steel castings." 1920, i. 389.—*Discussion*: J. E. Stead, 401.
- PRESTON, T. H., on iron ore in Russia. 1916, ii. 375.
- PRETET, on cooling phenomena in ingots. 1920, ii. 363.
- PREUSS, E., on brittleness due to working at blue heat. 1915, i. 598.
on distribution of stresses in perforated flat bars. 1913, i. 663.
on impact tests on notched bars. 1914, ii. 370.
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- PREUSS, G., on Corleis flask. 1913, i. 697.
on estimation of carbon, arsenic and sulphur in iron. 1911, i. 683.
- PREUSSLER, H., on distribution of forces in a rolling-mill. 1920, ii. 366.
- PRICE, JOHN WILLIAM, elected member. 1920, i. 5.
- PRICE, W. L., on haulage in collieries. 1914, i. 626.
on methods of working coal. 1914, i. 625, ii. 310; 1915, i. 534.
- PRICE-WILLIAMS, RICHARD, obituary notice of. 1916, ii. 364.
- PRIEST, CHARLES FREDERICK, elected member. 1921, i. 4.
- PRIESTLY, PERCY WILLIAM, elected member. 1920, i. 5.
- PRIMROSE, H. S., on testing machines. 1918, i. 538; 1921, i. 452.
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- PRIMROSE, J. S. G., on relation between ball hardness and scleroscope hardness. 1918, ii. 81.
on shock tests. 1917, ii. 115.
on testing machines. 1918, i. 538; 1921, i. 452.
on use of microscope in the foundry. 1911, ii. 571.
- PRINCE OF WALES, elected honorary member. 1919, ii. 5.
- PRINCE, W. F., on effect of high sulphur in castings. 1914, ii. 333.
on foundry mixtures. 1911, i. 593.
on pressure on the rolls of rolling-mills. 1911, i. 611.
on management of foundry operations. 1915, ii. 268.
- PRING, J. N., on synthesis of hydrocarbons. 1912, ii. 628.

- PRINGLE, J., on coal in Buckinghamshire. 1913, i. 536.
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- PRIOR, G. T., on meteorites. 1913, i. 518; 1914, i. 578, 579; 1915, i. 490; 1916, ii. 383.
- PRIWOZNIK, E., on occurrence and uses of manganese ore. 1912, i. 441.
- PROBERT, R. H., on semi-steel castings. 1913, ii. 598.
- PROBYN, HARRY, elected member. 1920, ii. 5.
- PROCTOR, VERNON, elected member. 1917, ii. 4.
- PROKOPOFF, K. A., on petroleum in Russia. 1915, i. 520.
- PROSSER, W. T., on petroleum in the United States. 1911, ii. 514.
- PROST, E., on estimation of volatile matter in coal. 1912, ii. 628.
on distribution of vanadium. 1921, ii. 338.
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- PROUDLOCK, MARMADUKE REGINALD, elected member. 1918, ii. 3.
- PRUDHOMME, F., on green wood in the blast-furnace. 1921, i. 403.
- PRUEMONT, G. F. J., on tungsten ore in Bolivia. 1919, ii. 462.
- PRUTZMAN, P. W., on petroleum in California. 1912, ii. 498; 1913, ii. 553.
- PUBING, F., on recovery of benzol from coal-gas. 1914, i. 605.
- PUCCI, F. S.—
Paper on "The present state of the iron industry in Italy." See L. DOMPÉ.
- PUGH, JOHN VERNON, elected member. 1914, ii. 2.
- PUGH, M. R., on corrosion of cast-iron pipes. 1914, ii. 387; 1915, ii. 326.
- PUGSLEY, HOWARD, elected member. 1921, i. 4.
- PUGSLEY, THOMAS MONTAGUE, elected member. 1917, i. 3.
- PULSFORD, F. C., on making cores of silica sand. 1914, ii. 329.
- PULSIFER, H. B., on heat-treatment of tool steel. 1913, ii. 641.
on metallography. 1915, i. 620.
- PULTZ, J. L., on purchase of fuel by analysis. 1912, ii. 476.
- PUNING, F., on Kopper's benzol recovery plant. 1913, ii. 549.
- PUPPE, J.—
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- PUPPE, K., on roll drafting. 1915, ii. 290.
- PURCELL, P. F., on peat resources of Ireland. 1920, ii. 326.
- PURDY, R. C., on refractories. 1920, i. 678.
- PURINGTON, C. W., on zirconium in Russia. 1916, ii. 382.
- PURVES, G. T., on by-product recovery. 1914, ii. 294; 1915, ii. 237; 1916, ii. 409.

- PÜTMAN, ARTHUR, obituary notice of. 1914, ii. 255.
 PUTNAM, W. J., on effect of cold-working on fatigue. 1919, i. 686.
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 PUTNAN, W. P., on malleable castings. 1911, i. 604, 637, ii. 597.
 PÜTZ, O., on methods of working coal. 1912, ii. 511 ; 1913, ii. 567 ; 1914, i. 625.
 PYATT, WILLIAM, elected member. 1920, i. 5.
 PYNE, A. P., on electricity in rolling-mills. 1920, i. 368.
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 PYE-SMITH, A., vote of thanks by. 1914, ii. xxii.
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- QUICKEL, R. D., on clinkering of coals. 1914, i. 594.
 QUIGLEY, J. S., on drawing pillars in pitching seams. 1915, i. 534.
 QUIGLEY, W. S., on installation for using pulverised coal as fuel. 1914, ii. 285.
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- RABAULT, ALBERT VALENTIN, elected member. 1914, i. 3.
 RACKOFF, A. A., on pouring of steel. 1921, i. 429.
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- RAMP, H. M.**, on faulty castings. 1915, ii. 272.
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- RAMSAY, E.**, on methods of working coal. 1912, ii. 511.
- RAMSAY, SIR W.**, on conservation of coal in Great Britain. 1911, ii. 671.
- RAMSBURG, C. J.**, on coking practice. 1917, ii. 368.
- RANDALL, CHARLES R. J.**, elected member. 1914, ii. xx.
- RANDALL, D. T.**, on selection of fuel by analysis. 1911, i. 539.
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- RANDALL, M.**, on specific heat of gases. 1912, ii. 629.
- RANGLES, SIR JOHN**, on blast-furnace practice in the United Kingdom. 1918, i. 67.
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- RANDOLPH, C. P.**, on electrolytic deposition of metals. 1911, i. 672.
- RANDS, H.**, on brown coal in New Zealand. 1919, ii. 474.
- RANG, HENRY ALBERT JULE**, elected member. 1918, ii. 3.
- RANGEL, M.**, on mineral resources of Durango. 1921, ii. 336.
- RANSOM, R. S., JUN.**, on estimation of tungsten. 1919, i. 701.
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- RANSOME, ALLEN**, obituary notice of. 1913, ii. 481.
- RANSOME, F. L.**, on manganese in Arizona. 1920, i. 672.
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- RAO, KUPPUSETTY JAGGA**, elected associate. 1918, ii. 4.
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- RASSON, E.**, on phosphorus etching reagent. 1919, i. 690.
- RASTALL, R. H.**, on tungsten ore. 1919, i. 625; 1920, i. 674.
- RATEAU, A.**, on blowing-engines. 1912, i. 497.
- RATH, on coal-handling. 1913, ii. 574.**
on mine ventilation. 1911, i. 570.
- RATBERT, W.**, on passivity of metals. 1914, i. 738.
- RAULIN, G.**, on analysis of ferro-boron. 1911, ii. 657.
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- RAVEN, F. A.**, on properties of ferro-silicon. 1920, i. 739.
- RAWDON, H. S.**, on arc welding. 1921, i. 444.
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- RAWDON, H. S., on microstructure of iron and steel. 1917, ii. 433; 1919, i. 691, 693; 1920, ii. 389.
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- RAWLIN, F. I. G., on the microscope. 1920, i. 757.
- RAWLINSON, W., on iron foundry practice. 1916, i. 338; 1921, i. 411.
- RAWSON, THOMAS GREGORY, elected member. 1917, i. 3.
- RAWSTRON, GEORGE PICKUP, elected member. 1913, i. 3.
- RAY, B., on influence of copper on steel. 1914, i. 728.
- RAY, W. T., on heat conductivity of refractory material. 1911, ii. 495.
- RAYDT, U., on alloys of iron and zinc. 1914, i. 730.
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- RAYMOND, A. W., on pulverised coal as fuel in metallurgical furnaces. 1913, ii. 617.
- RAYMOND, R. W., on coal resources of Alaska. 1912, ii. 485.
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- RAYMOND, S. S., on time effect in reheating hardened steel. 1916, i. 397.
- RAYNER, H. S., on fuel economy. 1919, ii. 130.
- READ, A. A.—
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- READ, H. L., on surface combustion. 1917, i. 307.
- READ, J., on petroleum in Papua. 1920, ii. 336.
- READ, T. T., on coal in China. 1912, i. 465.
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- REAGEN, A. B., on coal in New Mexico. 1912, i. 469.
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- REARDON, W. J., on core-moulding machine. 1915, ii. 270.
- REAVELL, JAMES ARTHUR, elected member. 1921, i. 4.
- REAY, T. P., obituary notice of. 1912, i. 417.
- REBUFFAT, O., on Dinas bricks. 1921, ii. 341.
- RECH, K., on slag-grinding mills. 1917, ii. 413.
- RECKTENWALD, J., on electric winding engines. 1912, ii. 512.
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- REDANELLI, ERNESTO, elected member. 1918, ii. 3.
- REDDING, A. M., on pyrometers. 1921, i. 437.
- REDDY, B. H., on American rolling-mills. 1911, i. 615.
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- REDFIELD, A. H., on petroleum in Canada. 1921, ii. 355.
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- REDFIELD, S. B., on Monel metal. 1911, i. 670.
- REDLICH, K. A., on magnesite. 1913, ii. 530.
- REDMAYNE, R. A. S., on colliery explosions. 1913, ii. 569
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- REDPATH, WILLIAM, elected member. 1920, i. 5.
- REDWOOD, SIR B., on future of oil fuel. 1914, i. 614.
- REED, C., on direct current for steel melting. 1921, i. 423.
- REED, EVERETT LENOX, elected member. 1918, i. 5.
- REED, J. C., on calorimetry. 1920, i. 685.
- REED, R. S., on measurement of blast-furnace gases. 1921, i. 398.
- REES, E., on coke-oven gas for town lighting. 1918, ii. 454.
- REES, GWILYN, elected associate. 1921, i. 6.
- REES, N. R., on gas-producers. 1921, i. 394.
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- REES, W. D., obituary notice of. 1921, ii. 330.
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- REEVES, F., on creep of rails. 1918, ii. 500.
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- REGAN, WILLIAM, elected associate. 1917, ii. 5.
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- REGER, D. B., on analyses of American coals. 1921, ii. 349.
- REICH, W. I., on oxy-acetylene welding. 1912, ii. 578.
- REICHARD, C., on estimation of phosphorous. 1912, i. 602.
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- REICHEL, J., on by-product recovery. 1913, ii. 547.
- REICHEL, on use of coke as boiler fuel. 1919, ii. 470.
- REICHSTEIN, G., on passivity of metals. 1914, i. 737.
- REICHWALD, VICTOR BALZAR, elected member. 1911, ii. 10.
- REID, E. W., on analysis of cast nichrome. 1917, ii. 464.
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- REIDEMEISTER, on modern coke-oven practice. 1916, ii. 399.
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- REIMERS, T., on effect of bending a crystalline rod. 1913, ii. 675.
- REIN, C., on advantages of fore-hearth for use with cupolas. 1914, ii. 326.
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- REINBOTH, F., on protective coatings. 1911, ii. 654.
- REINDERS, W., on the iron-carbon-oxygen system. 1917, i. 414.
- REINECKE, L., on mineral deposits in British Columbia. 1921, i. 371.
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- REINHARDT, GUSTAV, elected member. 1914, ii. xx.
- REINHARDT, G. A., on case-hardening of special steels. 1913, i. 644.
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- REINHARDT, K., on coal-washing. 1911, i. 577.
- REINHOLD, O., on mechanical properties of steel at high temperatures. 1916, ii. 447.
- REININGER, G., on classification of foundry iron. 1914, i. 658.
- REITMEISTER, W., on reversing valves in regenerating furnaces. 1913, ii. 614.
- REJTÖ, S., on prevention of hardening cracks in tool steel. 1921, i. 226.
- REMINGTON, ALFRED ARNOLD, elected member. 1917, ii. 4.
- REMY, W., on underground fires. 1914, i. 630.
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- RENGADE, E., on changes in silica bricks during service. 1918, ii. 441.
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- RENNERFELT, I., on efficiency of induction furnaces. 1914, i. 678.
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- RENTON, JAMES, elected member. 1912, ii. 6.
- REPETTI, CARLO, elected member. 1918, i. 5.
- REPERT, A. E., on methods of working in collieries. 1911, ii. 530.
- REQUA, M. L., on petroleum in California. 1912, i. 475, ii. 642.
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- RESAL, J., on influence of rate of shock. 1912, i. 568.
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- RESPONDEK, G., on application of Röntgen rays to the examination of metals. 1919, i. 689.
- RETALLACK, MARK NICHOLLS, elected member. 1913, ii. 5.
- RETTEW, E. W., on composition of high-speed steel. 1919, ii. 510.
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- RETZOW, on hardness testing. 1921, i. 453.
- REUBOLD, W., on coke quenchers. 1913, i. 548.
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- REUTER, WOLFGANG, elected member. 1914, i. 3.
- REUTERSKJOLD, ARVID, obituary notice of. 1916, i. 274.
- REVEL, P., on electric equipment in collieries. 1912, ii. 509.
- REVILLON, J. W., on coal industry of South Russia. 1915, i. 507.
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- RÉVILLON, L., on impact tests at varying temperatures. 1911, i. 652.

- RÉVILLON, L., on pickling of metal surfaces. 1920, i. 738.
- REVOL, G., on economics of high-speed tool steel. 1915, ii. 350.
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- REYNOLDS, ALLEYNE—
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- REYNOLDS, EDWARD ALLEYNE, elected member. 1919, ii. 4.
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- REYNOLDS, S. G., on equipment of collieries. 1914, i. 623.
- RHEAD, E. L., on alloy steels for motor cars. 1911, i. 656
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- RHEAD, T. F. E., on recovery of benzol from gas. 1917, i. 317.
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- RICARDO, H. R., on pistons for internal combustion engines. 1917, ii. 443.
- RICE, B. F., on grading iron ore. 1912, i. 446.
- RICE, C. J., on hardness testing of coke. 1921, i. 387.
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- RICE, R. H., on application of turbo-blowers for blast-furnaces. 1914, ii. 321.

- RICE, R. H., on air compressors for cupola blowing. 1911, ii. 559.
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- RICE, S., on electric smelting of iron ores. 1912, ii. 531.
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- RICH, C. H., on estimation of chromium and vanadium in steel. 1915, ii. 330.
- RICH, J. L., on iron ore in the United States. 1911, i. 519.
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- RICHARDS, DAVID, elected member. 1913, i. 3.
- RICHARDS, EDWIN, obituary notice of. 1916, i. 274.
- RICHARDS, E. WINDSOR, resolution of thanks to. 1920, ii. 7.
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- RICHARDS, F., on foundry costs. 1912, ii. 552.
- RICHARDS, JOHN ARTHUR, elected member. 1913, ii. 5.
- RICHARDS, J. W., on electric smelting of iron ore. 1912, ii. 531.
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- RICHARDS, M. E., on loading of ore. 1917, i. 289.
- RICHARDS, R. W., on coal in Montana. 1920, ii. 326.
- RICHARDS, S. W., on production of alumina. 1913, ii. 528.
- RICHARDS, T. W., on analysis of solutions. 1912, ii. 627.
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- RICHARDSON, C., on composition of Trinidad asphalt. 1915, i. 526.
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- RICHARDSON, C. E., on hardening and tempering furnaces. 1917, i. 378.
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- RICHARDSON, C. N., on brittleness produced in steel springs by electro-plating. 1917, i. 402.

- RICHARDSON, E. A., on corrosion. 1915, i. 625; 1917, i. 417; 1920, ii. 394; 1921, i. 469.
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- RICHARDSON, G. A., on heat-treatment of steel for gears. 1919, i. 674.
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- RICHARDSON, J. J., on sand-blasting. 1916, ii. 427.
- RICHARDSON, L. T., on corrosion. 1917, i. 417; 1920, i. 760, ii. 394; 1921, i. 469.
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- RICHARDSON, W. D., on corrosion. 1920, ii. 394.
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- RICHARME, E., on oil-fired open-hearth furnaces for steel foundries. 1912, i. 516.
- RICHE, J. A., on improved type of calorimeter. 1914, i. 592.
- RICHES, T. HURRY, obituary notice of. 1911, ii. 456.
- RICHMONDS, G. F., on petroleum in the Philippine Islands. 1911, ii. 514.
- RICHTER, G., on coal-cutting machinery. 1913, ii. 566.
- RICHTER, H. W., on constancy of copper-constantan thermo-element. 1917, ii. 360.
- RICKARD, T. A., on valuation of metal mines. 1917, i. 289.
- RICOLFI, F., on hardness tests. 1914, i. 705, ii. 367; 1917, i. 400.
- RIDDELL, M., on fluidity of molten cast iron. 1918, ii. 466.
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- RIDDELL, W. C., on analysis of magnesite. 1921, i. 473.
- RIDEAL, E. K., on electrolytic theory of corrosion. 1914, i. 736.
- RIDER, BERNARD, elected member. 1918, i. 5.
- RIDGE, CHARLES WILLIAM, elected associate. 1917, i. 6.
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- RIDGE, H. M., on fuel economy. 1919, ii. 108.
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- RIDGE-BEEDLE, PETER DENNISTON, elected member. 1917, i. 3.
- RIDGWELL, JOHN LESLIE, elected associate. 1921, i. 6.
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 on mechanical methods of analysis. 1912, i. 606.
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- RIDSDALE, C. H., and N. D. RIDSDALE—
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- RIDSDALE, H. H., on Staffordshire and Warwickshire coal-fields. 1921, i. 382.
- RIDSDALE, JOHN HUGH, elected member. 1911, i. 3.
- RIDSDALE, N. D.—
*Paper on "A new method for the accurate determination of phosphorus."
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 elected member. 1911, i. 3.
- RIEDEL, F., on cooling of highly heated iron masses. 1920, i. 732.
 on determination of power requirements of forging presses. 1914, i. 683.
- RIEGER, H., on non-corrosive alloys. 1920, i. 759.
- RIEGER, S., on Carinthian iron industry. 1912, ii. 534.
- RIEKE, R., on calorimetry. 1912, i. 458.
- RIEPPEL, A. VON, on international specifications for iron and steel. 1912, ii. 372.
- RIES, H., on fireclay deposits of Canada. 1913, i. 528.
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- RIETKÖTTER, G., on recovery of iron from foundry waste. 1912, i. 513.
- RIGBY, E. G., on electric welding with covered electrodes. 1919, i. 678.
- RIGBY, FRANK, elected member. 1921, i. 4.
- RIGG, G., on manufacture of firebricks. 1913, ii. 526.
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- RIGGS, J. S., on electric driving of rolling-mills. 1915, ii. 290.
- RIGHTMIRE, R. E., on classification of fuel. 1911, i. 539.
- RIKER, E. W., on foundry costs. 1913, ii. 610.
- RILEY, EDWARD, presentation of Bessemer Gold Medal to. 1914, i. 20.
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- RILEY, JAMES LOUIS, elected member. 1911, i. 3.
- RILEY, T. H., on producing sulphate of ammonia at by-product coke-ovens. 1916, i. 314.
- RING, C. N., on electric furnaces in foundries. 1921, i. 413.
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- RINSUM, W. VAN, on thermal conductivity of refractory bricks. 1920, i. 680.
- RIPLEY, C. M., on gas-producer installations in New York. 1916, i. 322.
- RIPLEY, LOUIS, elected member. 1917, ii. 4.
- RIPPER, W., on cutting tests with tool steels. 1914, i. 707.
- RIPON, J. E.—
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- RITCHIE, A. E., on coal in Kent. 1914, i. 598; 1919, i. 638.
- RITCHIE, G. H., on blast-furnace practice. 1920, i. 226.
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- RITCHIE, G. MURE, on welfare of the iron trade. 1916, i. 24, 25, 26, 27.
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- RITCHIE, RONALD JAMES HOWSON, elected member. 1917, i. 3.
- RITER, G. W., on nature of mining rights. 1915, i. 540.
- RITTERSHAUSEN, F., on steels for the chemical industry. 1921, ii. 415.
- RITTMANN, W. F., on analysis of petroleum. 1915, ii. 335; 1916, i. 402.
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- ROAST, H. J., on magnesite in Quebec. 1912, ii. 470.
- ROBBINGS, G., on coal washing. 1911, i. 577.
- ROBERT, M. H., on estimation of gaseous volumes during reaction. 1919, ii. 541.
- ROBERTS, C. E., on aluminium-silicon alloys. 1914, ii. 382.
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- ROBERTS, D. E., on blast-furnace construction. 1912, ii. 520.
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on the Roe puddling process. 1913, i. 599.
- ROBERTS, F. C., on blast-furnace charging appliances. 1915, ii. 258.
on blast-furnace construction. 1913, i. 580.

- ROBERTS, GEORGE ALBERT, elected member. 1914, ii. xx.
- ROBERTS, G. G., on use of wrought iron. 1917, ii. 433.
- ROBERTS, G. H., on co-ordination of testing methods. 1913, ii. 670.
- ROBERTS, H. W., on manganese and open-hearth rails. 1919, i. 687.
- ROBERTS, J., on low-temperature carbonisation. 1921, ii. 352.
on shaft-sinking. 1914, i. 622.
- ROBERTS, N., on crucible furnaces. 1911, i. 616.
- ROBERTS, S. S., on power requirements of rolling-mills. 1912, ii. 569.
- ROBERTS, W. D., on coal in the United States. 1911, i. 546.
- ROBERTS, W. R., on methods of working in collieries. 1911, i. 567.
- ROBERTSON, A., on strength of structural material. 1915, ii. 313.
on tensile properties of steel. 1913, ii. 653.
- ROBERTSON, A. J., on concentration of tungsten-molybdenum ores. 1917,
i. 290.
on tungsten-molybdenum ore in Western Australia. 1916, i. 301.
- ROBERTSON, FREDERICK DUNCAN STRUAN, elected member. 1919, i. 5.
- ROBERTSON, F. E., on production of sound ingots. 1912, ii. 69.
- ROBERTSON, G. S., on effect of basic slags on grasslands. 1920, i. 722.
- ROBERTSON, I. W., on analysis of natural-gas. 1916, i. 402, ii. 469.
on compressibility of natural gas. 1916, ii. 407.
on estimation of sulphur in fuel. 1912, ii. 628; 1913, i. 696.
on gases in mines. 1914, ii. 311; 1917, i. 334.
on separation of illuminants in gases. 1915, i. 636.
- ROBERTSON, J. A., on fuel economy. 1917, ii. 362.
- ROBERTSON, J. M., speech at Dinner by. 1912, i. 395.
- ROBERTSON, L. B., on by-product recovery. 1913, ii. 549.
- ROBERTSON, L. S., obituary notice of. 1916, i. 274.
- ROBERTSON, T. D., on electric furnaces. 1912, i. 541; 1915, i. 574.
on electric smelting of iron ore. 1912, i. 507; 1913, i. 595.
on refining of steel in electro-metals furnace. 1913, i. 627.
- ROBERTSON, W. F., on corrosion of wire ropes. 1919, i. 699.
on mineral statistics of British Columbia. 1912, i. 618.
- ROBERTSON, W. H. A., on rolling-mill design. 1919, i. 670.
elected member. 1912, i. 4.
- ROBIN, FELIX—
Paper on "The variation in the acoustic properties of steel with changes of temperature." **C.S.M.**, 1911, iii. 125; preliminary, 125; relation of the variations in the duration of the sound emitted by metals to variations of the temperature, 138; experiments on certain metals and alloys, 173; suggested explanation of the phenomenon—scientific conclusions, 186; Appendix I. Diagram of the resonance of alloys, 197; Appendix II. Variations of the resonance of steels with varying heat-treatment, 201; Appendix III. Pitch of sound, 201; Appendix IV. Note on the influence of the mode of suspension of metallic bars and of their dimensions on the duration of the sound, 203; notes by F. Osmond, 214.
- Paper* on "Microscopical examination of the depression made on steel by a conical point." **C.S.M.**, 1911, iii. 216.
- on allotropy of iron. 1912, ii. 282.
- on case-hardening. 1914, i. 689.
- on colour etching of steels. 1911, ii. 634.
- on demagnetisation of steels on heating. 1912, ii. 599.

- ROBIN, FELIX, on hardness measurement. 1918, i. 536.
 on heat-treatment of steel. 1911, i. 635.
 on influence of annealing on microstructure of steel. 1912, ii. 576; 1913, ii. 660, 661; 1914, ii. 358.
 on mechanical properties of metals. 1912, ii. 382.
 on metallographic analyses of carbon steels. 1911, i. 682.
 on metallographical appliances. 1913, i. 661.
 on relation between solubility, structure and temperature of working in steels. 1913, ii. 686.
 on transformations of iron below 700° C. 1912, ii. 382.
 on uniform nomenclature in metallography. 1912, ii. 382.
 on variation of hardness of steels with temperature. 1912, ii. 382.
 on wear of steel. 1911, i. 653; 1912, ii. 369.
 awarded Carnegie Gold Medal. 1911, i. 25.
- ROBINSON, A. H. A., on iron ore in Ontario. 1921, ii. 335.
- ROBINSON, F. C., on manufacture of petroleum products. 1913, ii. 554.
- ROBINSON, F. G., on moulding gas-engine cylinders. 1913, ii. 606.
- ROBINSON, F. W., on estimation of carbon. 1912, ii. 617.
 on resistance thermometry. 1920, i. 687.
- ROBINSON, I. V., on utilisation of waste heat of furnaces. 1913, i. 624.
- ROBINSON, JOHN ETESON, elected member. 1919, ii. 4.
- ROBINSON, J. G., on core binders. 1916, i. 342.
 on moulding. 1912, ii. 544; 1915, i. 564.
- ROBINSON, L. T., on magnetic properties. 1911, ii. 633.
- ROBINSON, S., design of expanding boring tool. 1917, i. 377.
- ROBINSON, S. R., on small converters in foundries. 1913, i. 610.
- ROBINSON, T. W., on Héroult furnace at Chicago. 1912, ii. 559.
 on the Triplex process. 1918, ii. 472.
- ROBINSON, W. H.—
Paper on "Steelworks yields." *See* LONGMUIR, P.
 on foundry yields. 1914, ii. 335.
- ROBSON, J. T., on flash point of gasoline-kerosene mixtures. 1920, i. 701.
- ROCCATI, A., on coal in Heraclea. 1921, i. 383.
- ROCHE, H. M., on methods of working iron ore. 1915, ii. 222.
- ROCHOW, W. F., on selection of refractories. 1920, i. 677.
- ROCK, M. M., on heat-treatment of castings. 1921, ii. 391.
 on macrostructure of cast steel. 1921, i. 464.
- RODANO, A. G., on petroleum in Italy. 1915, i. 520.
- RODE, F., on gas-producer. 1915, i. 528.
- RODEJA, V. G., on separation of vanadium and phosphorus. 1915, i. 633.
- RODENHAUSER, W., on electric production of steel. 1911, ii. 592; 1912, i. 539; 1913, i. 628.
 on electric smelting of iron ore. 1914, i. 650.
- RODIGIN, P., on influence of additions to cast iron. 1914, i. 660.
- RODZIEWICZ-BIELEWICZ, A., on "creeping" during rolling. 1914, i. 696.
- ROE, J. P., on reactions of the puddling process. 1913, ii. 591.
 obituary notice of. 1921, ii. 331.
- ROE, S., on types of cupolas. 1918, ii. 466.
- ROEBER, E. F., on electric steelmaking. 1915, ii. 280.
- ROESCHLAUB, H. M., on oil shale in United States. 1920, i. 700.

- ROESLER, M., on iron ore in Cuba. 1916, ii. 377.
 on iron ore resources of Europe. 1921, ii. 337.
- ROESNER, W. H., on steel castings. 1921, ii. 371.
- ROESSLER, A. C., on gas for heat-treating. 1921, i. 438.
- ROGERS, A. F., on nickel ores of Sudbury. 1917, i. 287.
 on origin of nickel ores. 1917, ii. 342.
- ROGERS, A. P., on petroleum in Wyoming. 1914, i. 612.
- ROGERS, A. W., on iron ore in South Africa. 1915, ii. 217.
- ROGERS, C. S., on helium-bearing natural-gas. 1921, ii. 357.
- ROGERS, E. D., on properties and uses of alloy steel. 1916, i. 376.
- ROGERS, F.—

Paper on "The investigation of fractures." 1912, i. 379; methods of obtaining cross-section through the fracture, 379; author's method of printing from a fracture, 380; Appendix: Details of preparation and use of the tissue, 385.—*Discussion*: W. Rosenhain, 387.—*Correspondence*: C. H. Ridsdale, 387; J. E. Stead, 388.

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Paper on "Brittleness in nickel-chrome and other steels." 1919, ii. 235. (*Discussion*: Conjointly with paper by Dr. J. H. Andrew, q.v.).

Paper on "Brittleness in nickel-chrome and other steels." Part II. 1920, i. 613.—*Discussion*: H. Brearley, 618; J. H. S. Dickenson, 619; W. H. Hatfield, 620; J. H. Andrew, 621; J. E. Stead, 622; J. H. G. Monypenny, 622; J. F. Kayser, 623; J. A. Jones, 624; F. Rogers (reply), 624.

on the acid hearth and slag. 1919, i. 243.

on allotropy of iron. 1912, ii. 283.

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on cold flow of steel. 1913, i. 112.

on critical ranges of pure iron. 1913, i. 351.

on deoxidation and the influence of lime on equilibrium in the acid open-hearth furnace. 1919, i. 271.

on failure of boiler plates in service. 1917, ii. 176.

on gases evolved on heating steel. 1912, ii. 241.

on high-speed steel. 1919, i. 341.

on impact tests. 1911, i. 652.

on effect of initial temperature on physical properties of steel. 1920, i. 609.

on influence of strain in metals. 1913, i. 664; 1920, i. 459.

on influence of sulphur on stability of iron carbide. 1913, i. 157.

on the manufacture of files. 1919, i. 378.

on manufacture of open-hearth steel. 1912, ii. 111.

on metallurgy of steel. 1919, i. 196.

on nickel-chrome steels. 1919, ii. 391.

- ROGERS, F., on oxygen content of open-hearth steel. 1914, ii. 191.
 on preparing sections of fractures for microscopical examination. 1913, ii. 389.
 on production of sound ingots. 1912, ii. 68; 1913, i. 72; 1917, i. 98; 1918, i. 235.
 on pyrometry. 1918, i. 481.
 on shock tests. 1917, ii. 114.
 on soundness in castings. 1920, ii. 352.
 on tenacity and deformation of steel at high temperatures. 1913, i. 292.
 on woody fractures in transverse tests. 1919, ii. 219.
- ROGERS, F. E., on repair of rolling-mills. 1921, ii. 383.
- ROGERS, G. S., on coal in Montana. 1914, i. 602.
 on origin of coal. 1914, ii. 287.
 on sulphur in petroleum oils. 1917, ii. 375.
- ROGERS, J. B., on use of nut coke in blast-furnace. 1920, ii. 343.
- ROGERS, J. H., on safety in tinplate works. 1915, i. 592.
- ROGERSON, EDGAR HOLLIDAY, elected member. 1921, ii. 11.
- ROGERSON, HARRY R., obituary notice of. 1914, i. 555.
- ROGERSON, T. B.—
Paper: "Notes on the present knowledge and practice in regard to the briquetting of iron ores." See BARRETT, GUY.
 on blast-furnace practice. 1918, i. 66.
 on open-hearth practice. 1917, ii. 277.
 on Scottish pig-iron industry. 1914, i. 752.
- ROGERSON, WILLIAM E., obituary notice of. 1915, i. 464.
- RÜHL, G.—
Paper on "The constitution of the sulphide enclosures in iron and steel and the desulphurisation process." C.S.M., 1912, iv. 28.
 awarded Carnegie Research Grant. 1911, i. 25.
- ROHLAND, on manufacture of firebricks. 1916, i. 304.
- ROHLAND, P., on corrosion of iron in concrete. 1912, i. 595.
- ROITZHEIM, A., on flow of gases in furnaces. 1912, ii. 524; 1913, i. 624.
- ROLFE, R. T., on the effect of silicon in cast iron. 1917, ii. 434.
 on mechanical qualities required in eyebolts. 1921, i. 462.
- ROLFES, B., on estimation of iron in iron ore. 1919, ii. 541.
- ROLLE, H., on permanent moulds. 1912, ii. 545; 1913, i. 613.
- ROLLINGER, on cold-rolling of metals. 1914, i. 697.
- RONALDSON, J. H., on coal. 1921, i. 382.
- RONCERAY, E., on machine-moulding practice. 1912, ii. 545; 1913, i. 614.
 on pouring castings. 1921, ii. 369.
 on production of malleable castings. 1912, ii. 549.
 on semi-steel shells. 1918, i. 502.
- RONNEBECK, H. R., on roll design. 1921, i. 434.
- ROONEY, T. E.—
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- ROOS AF HJELMSAETER, on endurance tests of machine steel. 1912, ii. 372.

- ROSE, B., on coal in Canada. 1911, ii. 509; 1917, i. 312.
on fireclay in Canada. 1917, i. 301.
- ROSE, SIR THOMAS KIRKE, elected member. 1914, i. 3.
- ROSE, WILLIAM HENRY, elected member. 1919, i. 5.
- ROSE, W. N., on stresses in steel. 1911, ii. 612.
- ROSENBERG, E., on contraction of cast iron. 1911, ii. 612.
on cupola practice. 1911, i. 592.
- ROSEBUSCH, GILBERT, elected member. 1913, i. 3.
- ROSENHAIN, W., on A_2 transformation of iron. 1915, i. 246.
on the amorphous theory of metals. 1913, ii. 654.
on behaviour of metals under strain. 1914, ii. 367.
on blast-furnace and cupola slags. 1921, i. 127.
on Brinell hardness and tenacity factors of heat-treated special steels. 1915, i. 138.
on carburisation of iron. 1915, ii. 118.
on case-hardening process. 1919, i. 402.
on chemical relations of iron, vanadium and carbon. 1912, i. 228.
on cleaning blast-furnace gas. 1920, ii. 86.
on cold flow of steel. 1913, i. 113.
on cooling of metals. 1915, ii. 319.
on cooling of steel in ingot and other forms. 1918, ii. 273.
on corrosion. 1916, i. 94.
on critical cooling velocities of chromium steel. 1916, i. 147.
on critical ranges of pure iron. 1913, i. 327.
on crystallising properties of electro-deposited iron. 1913, ii. 157.
on crystalline structure of iron. 1911, ii. 642.
on determination of critical points A_{r1} , A_{cl} . 1913, ii. 412.
on failure of boiler plates. 1914, i. 306; 1917, ii. 169.
on failure of metals. 1921, i. 459.
on a fourth recalescence point. 1912, i. 584.
on fractures. 1912, i. 387.
on furnace for testing refractories. 1919, ii. 466.
on hardening. 1914, i. 180, 245.
on hardening and tempering of high-speed steel. 1915, ii. 34.
on hardness of solid solutions. 1921, ii. 413.
on inclusions in steel and ferrite lines. 1918, i. 296.
on influence of cold-work on the divorce of pearlite. 1918, i. 362.
on influence of cold-working on the elastic properties of steel. C.S.M., 1918, ix. 168.
on influence of elements on mechanical properties of steel. 1916, ii. 110.
on influence of hot-deformation on qualities of steel. 1918, ii. 32.
on influence of manganese and carbon on corrosion of steels. 1916, i. 73.
on influence of phosphorus in iron and steel. 1915, i. 185, ii. 135.
on influence of sulphur on stability of iron carbide. 1913, i. 157.
on influence of surface tension upon the properties of metals. 1917, i. 177.
on intercrystalline cement in metals and elastic limit. 1916, i. 196.
on intercrystalline fracture of metals. 1920, i. 742.
on laboratory appliances. 1915, i. 629; 1918, i. 557.
on macro-etching and macro-printing. 1919, i. 289.

ROSENHAIN, W., on magnetic and mechanical properties of manganese steel. 1914, i. 127.

on microstructure of commercially pure iron. 1917, ii. 243.

on microstructure of steel. 1912, i. 581.

on National Physical Laboratory. 1916, ii. 467.

on nickel-chrome steels. 1919, ii. 385.

on pearlite. 1916, ii. 236.

on properties of ingots. 1916, ii. 174.

on properties of refractory materials. 1917, i. 61.

on reagent for detection of phosphorus in steel. 1914, ii. 381.

on resistance of ancient iron to corrosion. 1914, i. 736.

on Roentgen spectrographic investigations of iron and steel. 1921, i. 329.

on shock tests. 1917, ii. 105.

on slag enclosures. 1912, ii. 371.

on solubility of cementite in hardenite. 1912, i. 240.

on testing material. 1914, i. 703.

on tests for refractory materials. 1918, ii. 125, 133.

on transformation of steel during heat-treatment. 1911, ii. 56.

on U.S. National Research Council. 1919, i. 137.

on welding-up of blowholes in steel. 1911, i. 76; 1921, i. 44.

on woody fractures in transverse tests. 1919, ii. 221.

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Paper on "A new reagent for etching mild steel." 1914, i. 515; composition of the reagent, 517; effect of the reagent, 518; pitting, 523.—*Correspondence*: H. Brearley, 525; J. E. Stead, 526.

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Paper on "The tenacity, deformation and fracture of soft steel at high temperatures." 1913, i. 219; introduction, 219; object of the research, 221; apparatus, 223; material used, 230; test-pieces, 233; result of the research, 236; microscopic examination of strained and broken test-pieces, 255; references, 267.—*Discussion*: J. O. Arnold, 272; H. C. H. Carpenter, 278; Sir Robert Hadfield, 279; J. C. W. Humfrey, 282; W. Rosenhain, 282.—*Correspondence*: C. Benedicks, 284; W. H. Hatfield, 287; E. Heyn, 288; B. Hopkinson, 289; F. C. A. H. Lantsberry, 290; F. Rogers, 292; W. Rosenhain, 294; J. C. W. Humfrey, 312.

ROSENTHAL, T., on world's production of coal. 1914, i. 772.

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- ROSER, E., on low-temperature distillation of coal in gas-producers. 1920, ii. 340.
- ROSIN, J., on estimation of phosphoric acid. 1911, ii. 667.
- ROSIN, P., on heat-losses in metallurgical furnaces. 1921, i. 421, ii. 343.
- ROSS, ANDREW ALEXANDER, elected member. 1918, i. 5.
- ROSS, A. D., on magnetic properties of iron and iron alloys. 1913, ii. 677.
on magnetic properties of special steels. 1912, i. 576.
on magnetic properties of steel alloys at very low temperatures. 1913, i. 670.
- ROSS, C. P., on iron ore in Cuba. 1916, i. 294.
- ROSS, C. S., on geology of iron ore. 1916, ii. 374.
on molybdenum in New Mexico. 1921, i. 375.
- ROSS, D., on coal in the United States. 1911, i. 547.
on explosions in collieries. 1911, i. 573.
- ROSS, D. W., on properties of silica refractories. 1919, ii. 466.
- ROSS, E. F., on plant of Chapman Price Steel Co. 1921, ii. 381.
- ROSS, L. P., on failure of blast-furnace stock line brick. 1920, i. 679.
- ROSS, R. A., on briquetting of lignite. 1919, ii. 482.
- ROSS, W. H., on estimation of nickel and cobalt. 1911, ii. 663.
- ROSS, W. L., on extraction of potash from silicate rocks. 1917, ii. 357.
- ROSSENBECK, on mine ventilation. 1911, i. 570.
- ROSSER, GEORGE LEWIS, elected member. 1920, i. 5.
- ROSSI, A. J., on titanium in steel. 1918, i. 547.
- ROSSI, M., on production of ammonium sulphate from peat. 1915, i. 516.
- ROSSI, P., on Brinell hardness test. 1920, i. 742.
- ROSSIN, A., on open-hearth furnace regenerators. 1920, ii. 359.
- ROSSITER, E. C., on preparation of zirconium. 1921, i. 472.
- ROSSMAN, L. A., on iron-ore washing. 1916, ii. 384.
- ROTH, J. W., on reinforced concrete foundry. 1914, i. 667.
- ROTH, W. A., on calorimetry. 1915, ii. 229.
on heat-combustion of graphite. 1913, ii. 529.
- ROTHAUG, G., on estimation of chromium. 1914, i. 743.
- ROTHERA, L., on electric driving of rolling-mills. 1914, i. 683; 1918, i. 521; 1920, ii. 368; 1921, ii. 380.
on gas-cleaning. 1920, i. 100.
on rolling-mill drives. 1921, i. 432.
elected member. 1913, ii. 5.
- ROTHERT, E. H., on smelting titaniferous ores. 1913, i. 583.
- ROTHPLETZ, A., on iron ore in Germany. 1913, ii. 497.
- ROTTSCHILD, S., on determination of nickel. 1917, i. 423.
- ROTTELEUR, on haulage in collieries. 1914, i. 626.
- ROTTHAUS, J. E., on magnetic surveying. 1915, i. 492.
- ROTTMANN, C. J., on determination of carbon in ferro-alloys. 1920, i. 763.
- ROUBIEU, S., on steel foundry practice. 1915, i. 563; 1916, i. 340.
on steel foundry sand. 1918, i. 506.
- ROUET, G., on electric driving of rolling-mills. 1914, ii. 345.
- ROUSH, G. A., on electrodes for steel furnaces. 1911, i. 626.
on microstructure of carbon. 1912, i. 582.
on relation of hardness to elastic limit. 1911, i. 651.
- ROUTH, (MISS) PHOEBE, elected member. 1918, ii. 3.

- ROWE, J. P., on coal in the United States. 1915, ii. 234.
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- ROWE, REGINALD HENRY MARSHALL, elected member. 1917, i. 4.
- ROWETT, F. E., on elastic hysteresis of steel. 1914, ii. 366.
 on influence of mechanical and thermal treatment on properties of steel tubes. 1915, i. 611.
- ROWLAND, H. H., on coal-cutting machinery. 1911, i. 566.
- ROWLANDS, T., on production of sound steel ingots. 1915, i. 78.
- ROWLEY, ERNEST WHITWORTH, elected member. 1918, ii. 3.
- ROWLEY, P., on forging practice. 1921, i. 431.
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- ROWSE, W. C., on methods of measuring gas for analysis. 1913, ii. 709.
- ROY, A. R., on manufacture of wootz steel. 1913, i. 602.
- ROY, E. V.—
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- ROYDS, W. M., on petroleum in Philippine Islands. 1914, ii. 298.
- ROYSTER, P. H., on manufacture of ferro-manganese. 1919, ii. 488.
 on pyrometry in blast-furnace work. 1920, i. 687.
- ROYSTON, HAROLD, elected member. 1913, ii. 5.
- RUBIES, S. PINA DE, on estimation of iron in chromite. 1912, ii. 623.
- RUDDIMAN, J., on cleaning of blast-furnace gas. 1918, i. 493.
- RUDELOFF, HANS—
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- RUDER, W. E., on "calorising" metals. 1915, ii. 327.
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 on influence of nitrogen on steel. 1920, i. 745.
 on influence of silicon on steel. 1917, ii. 447.
 on nature of intergranular cement. 1913, ii. 654.
 on solubility of tungsten and molybdenum. 1912, ii. 620.
 on specific resistance of sheet steel. 1914, ii. 377.
 on X-ray examination of metals. 1920, i. 758.
- RUDGE, W. A. D., on coal-dust experiments. 1914, ii. 312.
 on magnetic properties of meteoric iron. 1914, ii. 274.
- RUDOLPH, W., on steel passenger carriages. 1917, ii. 443.
- RUER, R., on fourth recalescence point in pure iron. 1914, ii. 379.
 on iron-carbon compounds. 1911, i. 665; 1921, ii. 414.
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 on solubility of graphite in iron. 1921, i. 450.

- RUER, R., on specific resistance of nickel-cobalt alloys. 1913, ii. 666.
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- RUFF, O., on alloys of carbon. 1921, i. 467.
on cobalt-carbon system. 1916, ii. 460.
on electric vacuum furnace. 1915, i. 629.
on fusibility and volatilisation of refractory materials. 1912, i. 454.
on heat-formation of iron carbide. 1912, i. 586; 1913, i. 683.
on the iron-carbon system. 1912, ii. 602; 1913, i. 682.
on manganese-carbon, nickel-carbon and iron-carbon system. 1916, ii. 460.
on melting-point of zirconia. 1918, i. 556.
on physical and chemical properties of metals at high temperatures. 1914, i. 618.
on properties of quaternary alloys. 1913, i. 674.
on properties of vanadium. 1912, i. 589.
on pseudo-eutectic temperature of iron-carbon alloys. 1917, i. 413.
on solubility of carbon in iron. 1911, ii. 644.
on solubility of carbon in nickel. 1912, ii. 604.
on tungsten-carbon alloys. 1914, i. 728.
- RUGAN, H. F.—
Paper on "The growth of cast irons after repeated heatings." 1912, ii. 311; method of preparation of the samples for the machine, 311; chemical analysis of alloys, 312; summary, 314; failure of a cast-iron steam separator while in service, 315; conclusions, 319. *See also* CARPENTER, H. C. H.
- RULE, F. G., on petroleum in Argentina. 1912, i. 476.
- RUMBOLD, W. G., on chromium ore. 1921, i. 375.
- RÜMELIN, G., on the iron-manganese system. 1915, i. 622.
on magnetic transformation of iron-carbon alloys. 1915, ii. 320.
- RUMMEL, K., on power requirements for rolling-mills. 1919, ii. 502.
on utilisation of blast-furnace and coke-oven gases. 1915, i. 529.
- RUPPERT, A., on cleaning of blast-furnace gases. 1913, i. 589.
- RUPPERT, L., on cleaning of blast-furnace gases. 1913, i. 588.
- RUSHMORE, D. B., on electricity in iron foundries. 1914, i. 666.
on lighting of collieries. 1912, ii. 514.
- RUSHTON, JOHN BRIMELOW, elected member. 1918, ii. 3.
- RUSHWORTH, DAVID, elected member. 1911, i. 3.
- RUSS, E. F., on electric furnaces. 1921, i. 425.
on regulation of electrodes. 1920, i. 721, ii. 360.
- RUSSELL, A., on chromite in the Shetlands. 1919, i. 623.
- RUSSELL, ARCHIBALD MCKERROW, elected member. 1918, i. 5.
- RUSSELL, E. J., on utilisation of basic slag. 1921, i. 428.
- RUSSELL, FRANK, elected member. 1915, i. 2.
- RUSSELL, G. A. V., on basic open-hearth practice. 1921, i. 419.
elected associate. 1917, i. 6.
- RUSSELL, JOHN, elected member. 1919, i. 5.
- RUSSELL, JOHN HERBERT, elected member. 1921, ii. 11.
- RUSSELL, J. W., on manufacture of springs. 1920, i. 735.
- RUSSELL, THOMAS F.—
Carnegie Memoir on "The constitution of chromium steels." 1921, ii. 247. Part I. Manufacture of the steels, 249; Part II. Thermal data, 253;

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Paper: "Note on 'The Ball Test.'" See BAKER, THOMAS.
on chromium steels. 1920, i. 485.

on estimation of chromium in steel and pig iron. 1918, ii. 508.

on relation between ball-hardness and scleroscope-hardness. 1918, ii. 85.
elected member. 1919, i. 5.

awarded Carnegie Research Grant. 1920, i. 12.

RUSSELL, W. M., on coke-oven gas plant. 1919, ii. 481.

RUTHERFORD, WALTER, elected member. 1912, ii. 6.

RUTLEDGE, J. J., on blasting by electricity. 1912, ii. 510.

RUTTER, F., lecture on "Art and the Iron Industry." 1912, ii. 428.

RUTZ, F. C., on air furnace for malleable cast iron. 1917, i. 353.

RYAN, F. J., on electric steel furnaces. 1917, i. 358, 365.

RYAN, W. T., on iron wire for electric transmission. 1918, i. 548.

RYBA, G., on rescue work in collieries. 1913, ii. 573.

RYDBERG, B., on wire-drawing. 1915, i. 592.

RYDER, H. M., on gases in steel. 1920, ii. 363.

RYLANDS, SIR W. PETER, elected Member of Council. 1914, i. 14.

vote of thanks by. 1913, i. 17.

RYN, C. F. W., elected member. 1912, ii. 6.

RZEHLKA, A., on coking properties of soft coals. 1914, i. 603.

on explosives and blasting. 1911, i. 565.

S

SABIN, A. H., on corrosion of iron. 1911, ii. 654.

on paints for structural steel. 1915, i. 628.

SACHS, E. O., on fire-resistance of concrete and reinforced concrete. 1912, ii. 385.

SACHS, K. P., on recovery of coal by-products. 1915, ii. 238.

SACONNEY, J., on the Terni steelworks. 1913, ii. 618; 1914, i. 675, 699.

on metallurgical exhibits at Ghent Exhibition. 1914, i. 651, 677, 679, 686, 691.

SACRISTAN, J., on wolfram deposits in Spain. 1914, ii. 273.

SADLER, HARRY STANLEY, elected member. 1917, ii. 4.

SADTLER, P. S., on estimation of oxygen in petroleum. 1913, ii. 708.

SAEMANN, H., on iron ore in the Fricktal. 1921, ii. 337.

SAHLIN, A.—

Paper on "The use of liquid ferro-manganese in the steel processes." 1914, ii. 213; value of manganese as a deoxidising and solidifying agent in manufacture of steel, 213; electro-ferro furnaces for recovery of manganese, 214; reason for high power consumption in melting ferro, 214; description of Rennerfelt furnace, 216; description of experiments, 218; results of tests, 222; conclusions, 226.—*Correspondence*: C. W. H. von Eckermann, 229; A. Sahlin (reply), 230.

on compressed air traction in coal-mines. 1914, i. 626.

on electric furnaces. 1919, i. 663.

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on the Rennerfelt electric furnace. 1914, i. 680.

- SAINSBURY, HENRY CECIL BAGLEY, elected member. 1918, i. 5.
- ST. CLAIR, G. A., on iron ore on the Mesaba Range. 1914, i. 574.
- ST. CLAIR, S., on petroleum in United States. 1919, ii. 478.
- ST. JOHN, H. M., on testing of electric furnaces. 1920, i. 719.
- SAINT-SMITH, E. C., on iron ore in Australia. 1919, i. 618.
 on magnesite in Queensland. 1919, ii. 465.
 on tungsten in Queensland. 1918, i. 473.
- ST. WARUNIS, T., on estimation of iron in chromite. 1912, ii. 623.
 on estimation of sulphur in coal. 1911, ii. 668.
- SAINTE-CLAIRE-DELVILLE, on coal in Germany. 1920, ii. 325.
- SAITO, S.—
 Paper on "Formation of spheroidal cementite." See HONDA, K.
 on magnet steel. 1920, ii. 387; 1921, i. 462.
 on state of carbide in carbon steels. 1921, i. 465.
- SAKAI, S., on heat-treatment of metals. 1921, i. 441.
- SAKLATWALLA, B. D., on development of ferro-vanadium. 1920, i. 709.
 elected member. 1911, ii. 10.
- SALADIN, E., on methods of working iron ore. 1914, i. 580.
 on new form of explosives magazine. 1913, ii. 566.
- SALDAU, P.—
 Paper on "Apparatus for the measurement of electric resistance of material in the solid state at high temperatures, and its application to the determination of the critical points of iron and steel." C.S.M., 1916, vii. 195.
 awarded Carnegie Research grant. 1916, i. 29.
- SALMANG, H., on recovery of coal by-products. 1915, ii. 239.
- SALMON, LLYFNWY THOMAS, elected associate. 1921, i. 6.
- SAMES, C. M., on power requirements in rolling-mills. 1916, ii. 438.
- SAMPELAYO, P. H., on bauxite in Catalonia. 1921, i. 374.
- SAMPSON, C. C., on blast-furnace gas-engines. 1913, i. 568.
 on cleaning of blast-furnace gases. 1913, i. 589.
- SAMPSON, R. J., on geology of coal. 1915, i. 505.
- SAMUELS, ISAAC, elected member. 1919, ii. 4.
- SANCHEZ, J. A., on separation of iron and manganese. 1912, i. 608.
- SAND, H. J. S., on electro-analysis. 1911, i. 685.
- SANDBERG, C. P., obituary notice of. 1914, i. 555.
- SANDBERG, C. P., JUN., on heat-treatment of steel rails. 1916, ii. 441.
 on influence of elements on mechanical properties of steel. 1916, ii. 123.
 on production of sound steel ingots. 1915, i. 78.
 on wear of rails. 1921, ii. 406.
- SANDBERG, N. P. P., on macro-etching and macro-printing. 1919, i. 299.
 elected member. 1914, ii. xx.
- SANDBERG, OSCAR FRIDOLF A., elected member. 1914, ii. xx.
- SANDELIN, F., on the Russian iron industry. 1915, i. 648.
- SANDELIN, HJALMAR FOLKE, elected member. 1921, ii. 11.
- SANDER, A., on production of gas from wood. 1920, i. 702.
 awarded Carnegie Research Scholarship. 1914, i. 24.
- SANDERS, CECIL MONTGOMERY, elected member. 1921, ii. 11.
- SANDERS, J., on iron ore in Arizona. 1912, i. 437.
- SANDERS, J. M., on determination of sulphur in petroleum. 1912, i. 612.
 on fractional distillation of petroleum. 1914, ii. 301.

- SANDERS, P. H., on preparation on zirconia. 1921, i. 472.
- SANDERS, T. H., on manufacture of springs. 1920, i. 735.
- SANDERSON, FREDERICK ISIDOR, elected member. 1917, i. 4.
- SANFORD, A. E., on drop-forging. 1917, i. 373.
- SANFORD, R. L., on influence of heat-treatment on magnetic properties of iron and steel. 1915, i. 615.
- on location of flaws in rifle-barrel steel. 1920, i. 752.
- on magnetic testing of ball-bearing races. 1920, i. 751.
- SANFORD, S., on composition of American coal. 1915, i. 506; 1916, i. 311.
- SANFOURCHE, A., on properties of iron-silicon alloys. 1919, i. 695; 1920, i. 739.
- SANG, A., on galvanising iron and steel. 1912, i. 597, 599.
- SANGOY, V., on coal in France. 1911, i. 543.
- SANITER, E. H., on the acid-hearth and slag. 1919, i. 243.
- on action of iron-oxides upon acid furnace structure. 1919, ii. 181.
- on calorimetric test for carbon. 1913, ii. 383.
- on carburisation of iron. 1915, ii. 114.
- on chemical and mechanical relations of carbon, chromium and iron, 1911, i. 266.
- on chemical and mechanical relations of iron, vanadium and carbon. 1912, i. 227.
- on chromiferous iron ores of Greece. 1913, i. 467.
- on cold flow of steel. 1913, i. 114.
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- on corrosion of metals. 1911, i. 166, 191; 1916, i. 96.
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- on electric steels. 1920, ii. 138.
- on failure of boiler plates in service. 1917, ii. 173; 1918, i. 326.
- on growth of cast iron. 1911, i. 237.
- on hardness testing and resistance to mechanical wear. 1912, ii. 369.
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- on influence of hot-deformation on qualities of steel. 1918, ii. 33, 35.
- on influence of manganese and carbon on corrosion of steel. 1916, i. 74.
- on influence of mass on heat-treatment. 1918, i. 351.
- on influence of nitrogen on iron and steel. 1915, ii. 104.
- on influence of phosphorus in iron and steel. 1915, i. 187.
- on intercrystalline cement in metals and elastic limit. 1916, i. 203.
- on intercrystalline fracture in mild steel. 1920, ii. 32.
- on macro-etching and macro-printing. 1919, i. 292.
- on mechanicalising analysis. 1911, i. 371.
- on microstructure of commercially pure iron. 1917, ii. 246.
- on the Nathusius electric furnace. 1912, i. 88.
- on nickel-chrome steels. 1919, ii. 386.
- on open-hearth furnace design. 1918, ii. 308.
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- on oxygen content of open-hearth steel. 1914, ii. 193.
- on production of sound steel. 1913, i. 67, ii. 293; 1916, ii. 205; 1917, i. 94; 1918, i. 234.
- on properties of refractory materials. 1917, i. 58.

- SANITER, E. H., on relation between ball hardness and scleroscope hardness. 1918, ii. 80.
 on relation between cutting efficiency and hardness of tool steel. 1916, i. 108.
 on shock tests. 1917, ii. 111.
 on slag in the open-hearth process. 1920, i. 308.
 on utilisation of waste heat from open-hearth furnaces. 1918, ii. 344.
 on welding-up of blowholes in steel. 1911, i. 73; 1921, i. 53.
 on woody fractures in transverse tests. 1919, ii. 211.
- SANJINES, C., on mineral resources of Bolivia. 1912, ii. 452.
- SANKEY, H. RIAL, elected member. 1913, ii. 5.
- SANKEY, JOHN WILLIAM, obituary notice of. 1913, ii. 481.
- SARGENT, G. W., on molybdenum steel. 1920, ii. 388; 1921, i. 467, ii. 404.
- SARJANT, R. J.—
Paper on "Fuel control in metallurgical furnaces." See HADFIELD, SIR ROBERT.
 on action of pyridine on coal. 1919, ii. 473.
- SARSON, THOMAS, elected member. 1914, i. 3.
- SATO, N., on growth of cast iron. 1920, ii. 379.
 on molybdenum steel for guns. 1919, ii. 508.
- SAUNDERS, on modern practice in rock drilling. 1914, i. 580.
- SAUNDERS, L. E., on uses of alumina. 1911, ii. 500; 1913, ii. 528.
- SAUNDERS, W. M., on moulding sand. 1915, ii. 270.
- SAUVAGE, on electric equipment of collieries. 1913, i. 570.
 on testing machines. 1918, ii. 493.
- SAUVEAU, G., on winding equipment. 1911, ii. 531.
- SAUVÉE, A., obituary notice of. 1914, ii. 256.
- SAUVEUR, A.—
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 on changes produced in steel by annealing. 1914, ii. 358.
 on crystalline growth of ferrite. 1912, ii. 382; 1913, i. 679.
 on crystallising properties of electro-deposited iron. 1913, ii. 149.
 on hardening of metals. 1914, i. 189, 259; 1915, ii. 306.
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 on heating and cooling curves of iron. 1914, i. 720.
 on heating and cooling curves of manganese steel. 1913, ii. 200.
 on heat-treatment of steel. 1919, ii. 508; 1920, ii. 372.
 on history of steel. 1921, i. 428.
 on influence of composition on properties of cast iron. 1913, i. 657.
 on the iron-carbon system. 1914, i. 725.
 on magnetic properties of manganese steel. 1914, i. 134; 1915, i. 616.
 on metallographical appliances. 1911, i. 661, ii. 634; 1912, i. 579.

- SAUVEUR, A., on metallography and microstructure. 1912, i. 582.
 on the microscope. 1914, i. 716; 1920, i. 757.
 on microscopic constituents of iron and steel. 1912, ii. 375.
 on nomenclature of iron and steel products. 1912, ii. 374.
 on slip interference theory of hardening. 1921, ii. 413.
 on temperature conversion tables. 1921, i. 443.
- SAVAGE, GEOFFREY HERBERT, elected member. 1916, ii. 2.
- SAVAGE, H., on determination of phosphorus. 1913, i. 444.
 on production of sound steel. 1913, i. 59.
 on pulverised coal. 1920, ii. 322.
 elected member. 1912, ii. 6.
- SAVAGE, H. D., on use of pulverised fuel. 1921, i. 381.
- SAVAGE, T. E., on coal in the United States. 1911, i. 547, ii. 506.
 on geology of iron ore. 1916, ii. 374.
- SAVAGE, W., on action of iron-oxides upon acid furnace structure. 1919, ii. 181.
 on low-temperature carbonisation of coal. 1919, i. 640.
 elected member. 1918, i. 5.
- SAVELL, W. L., on electro-plating with cobalt. 1916, i. 366.
- SAVIRON, P., on gas-producers. 1913, i. 563.
- SAWHILL, R. V., on American steelworks. 1915, ii. 292; 1916, i. 349.
 on heating wire rods. 1916, i. 359.
 on working iron ore. 1915, i. 493.
- SAWTELL, HORACE DEWICK, elected member. 1914, i. 3.
- SAWTELLE, E. S., on carburising steel gears and pinions for rolling-mills, 1918, i. 525.
- SAWYER, A. H., on iron ore in Alabama. 1914, ii. 268.
- SAXTON, CLEMENT, elected member. 1920, i. 5.
- SAY, A., on coke-oven gases. 1911, i. 551.
- SAYERS, H. B., on electric welding. 1919, i. 677.
- SAYERS, H. M., on corrugation of steel rails. 1918, i. 542.
 on illumination of micrographic specimens. 1919, i. 694; 1920, i. 757.
- SAYRE, F. M., on ore-bins for storage of iron. 1914, ii. 277.
- SCAVIA, G., on case-hardening furnaces. 1911, ii. 595.
 on formation of cementite. 1911, ii. 635.
- SCHADECK, O. M., on standardisation of coke-oven plant. 1920, i. 696.
- SCHAEFER, C. T., on foundry patterns and moulding. 1912, i. 518.
- SCHAEFER, L., on roll-draughting. 1911, i. 611.
- SCHAFARZIK, on iron ore in Hungary. 1911, ii. 472.
- SCHÄFER, D., on sampling of ores. 1912, i. 607.
- SCHÄFER, R., on annealing steel castings. 1914, i. 694.
 on desulphurising properties of blast-furnace slag. 1913, ii. 589.
 on iron ore calcination. 1911, i. 534.
 on sulphur in coke. 1911, i. 550.
- SCHÄFER, W., on preparation of slag. 1921, ii. 366.
- SCHALL, M., on by-product recovery. 1913, i. 548.
- SCHALLER, L., on tests on structural iron. 1913, i. 660.
- SCHALLER, W. T., on ilsemaninite. 1917, ii. 343.
 on intumescent kaolinite in Oklahoma. 1917, i. 303.
 on tungsten ore. 1911, ii. 483.

- SCHAGRIN, H., on carburisation with wood charcoal. 1921, ii. 385.
- SCHAPRA, B., on iron industry of Czecho-Slovakia. 1921, i. 406.
on iron ore in Europe. 1920, ii. 314.
- SCHARTEL, on natural-gas in Germany. 1911, i. 558.
- SCHEEERER, on coal in Germany. 1913, i. 538.
- SCHAEFFER, L., on manganese ore resources of Germany. 1914, i. 577, ii. 401 ;
1915, i. 644.
- SCHAEFFLER, F. A., on use of pulverised coal. 1919, ii. 469.
- SCHAEFFENBAUM, F., on evolution of wire-rope industry. 1913, ii. 647.
- SCHENCK, R., on the iron-carbon system. 1912, i. 585.
- SCHICK, E., on utilisation of blast-furnace slag. 1911, ii. 557.
- SCHIEFER, H. V., on slag breakers. 1917, i. 346.
on steelworks equipment. 1918, i. 516.
- SCHIEL, K., on oil fuel in the foundry. 1911, ii. 560.
- SCHILLING, H., on analysis of ferro-chrome. 1915, ii. 332.
- SCHIMPKE, P., on welding. 1915, i. 592 ; 1916, i. 367.
- SCHINDLER, A., on ore-breaking machines. 1913, ii. 519.
- SCHINDLER, E., on application of producer-gas to boiler firing. 1912, i. 483.
- SCHIRMEISTER, H., on binary aluminium alloys. 1915, ii. 318.
- SCHLEICH, L. V., on manufacture and properties of carbon bricks. 1913, ii. 527.
- SCHLEICHER, ALADAR, elected member. 1911, ii. 10.
- SCHLEICHER, A. P., on electrical resistance of iron-nickel alloys. 1914, ii. 377.
- SCHLEICHER, S., on use of fluorspar in the open hearth. 1921, i. 421.
- SCHLEMMANN, W., on use of liquid ferro-manganese in Bessemer process. 1911,
ii. 586.
- SCHLESINGER, W. A., on oxide of carbon in blast-furnace gases. 1911, ii. 543.
- SCHLINK, F. J., on instrumental indication of resilience. 1919, i. 685.
- SCHLOTTER, M., on corrosion tests of galvanised sheets. 1919, ii. 534.
on electrolytic deposition of metals. 1914, ii. 383.
on nickel and cobalt plating. 1921, i. 449.
- SCHLUNDT, H., on recovery of vanadium and uranium. 1916, i. 401, ii. 385.
- SCHMALENBACH, on improved heating of Cowper stoves. 1914, i. 640.
- SCHMAUSER, on effect of sulphur on castings. 1921, i. 450.
- SCHMELZ, E., on electric production of steel. 1911, ii. 592.
- SCHMELZ, E. M., on Stassano electric furnace. 1914, i. 680.
- SCHMERBER, H., on electrical installations in French collieries. 1913, ii. 565.
- SCHMID, A., on Amsler-Laffon drop testing-machine. 1915, ii. 309.
on notched-bar tests. 1912, ii. 381.
on tests of moulding sand. 1915, i. 563.
- SCHMID, G., on manganese in Bulgaria. 1921, i. 370.
- SCHMID, M. H., on electric furnace practice. 1921, ii. 377.
on molybdenum steel. 1921, ii. 404.
elected member. 1916, i. 4.
- SCHMID, R., on new pig-casting machine. 1912, ii. 524.
- SCHMIDT, A., on iron ore in Germany. 1914, i. 570.
- SCHMIDT, C., on iron ore in Switzerland. 1921, ii. 337.
- SCHMIDT, F., on origin of coal. 1915, i. 506.
on shaft sinking. 1916, ii. 410.
- SCHMIDT, G. C., on passivity of metals. 1914, i. 737.
- SCHMIDT, M. R., on estimation of manganese. 1911, i. 686.

- SCHMITT, R., on petroleum as fuel in heating furnaces. 1915, ii. 246.
on properties of liquid fuel. 1915, i. 524.
- SCHMITZ, I., on influence of gases on iron. 1919, ii. 534.
- SCHMITZ, J., on an Hungarian rolling-mill. 1914, ii. 350.
on mechanical cooling-beds. 1912, i. 533.
- SCHMOLKE, H., on tar-oil as fuel. 1914, i. 614.
- SCHNABEL, A., on surface combustion in foundries and ironworks. 1914, i. 596.
- SCHNACKENBURG, L., on power requirements of rolling-mills. 1912, ii. 570.
- SCHNASS, E., on manganese ore-mining in the Caucasus. 1914, ii. 271.
on petroleum in Russia. 1914, ii. 296.
- SCHNEIDER, on converter blowers. 1911, ii. 587.
- SCHNEIDER, A., on heating open-hearth furnaces with blast-furnace gas. 1920, i. 715.
- SCHNEIDER, CHARLES, elected member. 1918, i. 5.
- SCHNEIDER, EUGENE—
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elected Vice-President. 1915, i. 14.
presentation of freedom of Blacksmiths' Company. 1919, i. 10.
speech at Annual Meeting. 1920, i. 8, 10.
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- SCHNEIDER, G., on mining industry of Bolivia. 1920, i. 675.
- SCHNEIDER, JEAN, elected member. 1918, i. 5.
- SCHNEIDER, J. J., on hardness testing. 1911, i. 650.
- SCHNEIDER, W., on hardening of electrolytic iron. 1921, ii. 401.
on utilisation of tar from gas-producers. 1917, i. 329.
- SCHNEIDER & Co., on relation between temperature and magnetic properties of iron and steel. 1912, ii. 382.
- SCHNEIDERHÖHN, H., on microscopical examination of iron ores. 1921, i. 376.
on ore deposits of South-West Africa. 1921, ii. 334.
- SCHNEIDERS, G., on shaft-sinking. 1914, ii. 307.
- SCHNIEWIND, F. W. C., obituary notice of. 1913, i. 491.
- SCHOCH, E. P., on electrolytic deposition of metals. 1911, i. 672.
on passivity of metals. 1914, i. 737.

- SCHOCK, N., on economy of open-hearth process in the Minette district. 1914, i. 671; 1915, i. 570.
- SCHOELLER, W. R., on analytical operations. 1915, i. 632.
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- SCHOELLER, W. R., and A. R. POWELL—
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- SCHOENFUSS, FRANK H., elected member. 1918, i. 5.
- SCHOFIELD, F. H., on pyrometers. 1918, i. 481.
- SCHOFIELD, T. R., on foundry patterns. 1912, ii. 544.
- SCHOLL, L. A., JUN., on coal-dust experiments. 1914, i. 629.
- SCHOLS, C., on the iron-carbon-silicon system. 1911, i. 665.
- SCHOLT, E. A., on foundry equipment. 1911, i. 598.
- SCHOLTZ, C., on use of steel in mine construction. 1913, ii. 564.
- SCHOLZ, F. W., on prevention of accidents in German foundries. 1912, ii. 550.
- SCHÖMBURG, W., on handling materials in steelworks. 1914, i. 674.
on rolling-mill accessories. 1913, i. 640.
on valves for open-hearth furnaces. 1915, i. 572.
- SCHOMBURG, W. S., on cost of production in open-hearth process. 1917, i. 345.
- SCHÖNEWEG, H., on removal of scaffolds in blast-furnaces by shot-firing. 1915, i. 550.
- SCHOOP, M. U., on spray process for coating metals. 1911, i. 680; 1913, ii. 694.
- SCHÖPF, A., on rolling of hoop-iron. 1921, i. 434.
- SCHÖPPE, W., on iron ore in Hungary. 1911, i. 517.
- SCHORRIG, E., on portable electric lamps for mines. 1914, i. 628.
- SCHOTT, E. A., on tinning of cast iron. 1919, ii. 515.
on use of coal-dust in moulding. 1914, i. 664.
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- SCHOTT, ROBERT, obituary notice of. 1915, i. 464.
- SCHOTTKY, H., on heat effect in high-carbon steel heated to 100°C. 1913, ii. 684.
- SCHÖTTLER, R., on tests on cast-iron bars. 1912, ii. 582.
- SCHRAMM, A., on Heraeus resistance thermometer. 1912, ii. 474.
- SCHRAMM, E., on appliances for steel analysis. 1917, i. 422.
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- SCHRAMM, E. F., on oil shales of Wyoming. 1921, i. 392.
- SCHRAMME, E., on surface combustion. 1916, ii. 393.
- SCHREIBER, E., on mill reheating furnaces. 1914, ii. 345.
- SCHREIBER, F., on action of fumes on refractory bricks. 1914, ii. 282.
on coal in India. 1911, ii. 508.
on coke-oven linings. 1911, i. 549.
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- SCHREIBER, J., on utilisation of waste heat of furnaces. 1913, i. 624.
- SCHRENK, H. VON, on preservation of mine timber. 1913, ii. 564.
- SCHRIEVER, A., on manufacture of wide-flanged beams. 1919, ii. 502; 1920, i. 728.
- SCHRÖDTER, E., on ancient stove plates. 1914, ii. 324.
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- SCHROEDTER, F., on melting ferro-manganese in the electric furnace. 1912, i. 540.
- SCHRUFF, F., on soaking-pits. 1913, ii. 632.
- SCHÜBBE, H., on magnetic testing. 1914, i. 713.
- SCHUCK, W. P., on costs of oxy-hydrogen and oxy-acetylene cutting. 1917, i. 388.
- SCHUDEL, B., on manganese steel castings. 1920, ii. 354.
- SCHUDT, C. O., on use of kerosene in gasoline engines. 1917, ii. 377.
- SCHUEN, W., on welds. 1911, i. 104.
- SCHUKOWSKY, S., on influence of segregation on rails. 1915, i. 606.
- SCHULGIN, N.—
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- SCHULTE, on colliery equipment. 1911, ii. 527.
- SCHULTE, W. B., on corrosion of iron and steel. 1912, ii. 608.
- SCHULTZ, A. F., on case-hardening. 1911, i. 630.
- SCHULTZ, A. R., on coal in Wyoming. 1914, ii. 290.
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- SCHULTZ, J. A., on die-castings. 1916, ii. 424.
- SCHULTZE, E., on coal resources of China. 1921, i. 383.
- SCHULZ, on the Mond gas-producer. 1914, i. 618.
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- SCHULZ, B., on specifications for metals. 1921, i. 462.
- SCHULZ, E., on origin of iron ore. 1914, i. 570.
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- SCHULZ, F., on properties of artificial petroleum. 1911, ii. 517.
- SCHULZ, G., on use of blast-furnace gas. 1921, i. 398.
- SCHULZ, M. R., on utilisation of waste heat of furnaces. 1912, ii. 525.
- SCHULZ, O., on underground haulage. 1911, i. 568.
- SCHÜLZ, R., on by-products from producer-gas. 1913, ii. 561.
- SCHULZ, W., on petroleum in Roumania. 1914, i. 610, 763.
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- SCHULZE, G., on electro-chemical behaviour of iron. 1912, ii. 614.
- SCHUMANN, A. F., on open-hearth practice. 1921, ii. 374.
- SCHÜPFAUS, H., on composition of manganese ores. 1912, ii. 455.
- SCHURECHT, H. G., on properties of fireclays. 1916, ii. 391.
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- SCHUYLER, A. H., on heat-losses in electric furnaces. 1916, i. 347.
- SCHÜZ, E., on the iron-nickel system. 1911, i. 667.
- SCHWABE, on coal in German East Africa. 1911, ii. 509.
- SCHWARTZ, on rail corrugation. 1913, ii. 672.
- SCHWARTZ, A., on German steelworks. 1914, i. 674.
- SCHWARTZ, H. A., on physical properties of malleable castings. 1919, i. 683,
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- SCHWARZ, C. DE, obituary notice of. 1912, i. 418.
- SCHWARZ, M. VON, on properties of ferro-silicon. 1914, i. 731; 1915, i. 574.
- SCHWARZ, R., on estimation of iron in iron ore. 1919, ii. 466; 1920, ii. 397.
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- SCHWARZE, B., on wear of tires. 1912, i. 572.
- SCHWARZE, H. V., on preparation of slag. 1921, ii. 366.
- SCHWEITZER, L., on oil-fired open-hearth furnaces. 1917, ii. 404.
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- SCOBEE, B., on methods of coal-mining in Kansas. 1913, i. 572.
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- SCOTT, A., on properties of silica firebricks. 1918, i. 476; 1919, ii. 466;
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- SCOTT, C. U., on hardening of dies. 1911, i. 634.
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- SCOTT, E. H., on utilisation of coke-oven gas. 1912, ii. 492.
- SCOTT, E. K., on electric furnaces. 1911, ii. 588; 1912, i. 88; 1913, ii. 601;
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- SCOTT, H.—
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- SCOTT, H., on influence of rate of temperature change on transformation of alloy steel. 1919, i. 695.
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- SCOTT, HENRY CHARLES, elected member. 1912, i. 4.
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- SCOTT, WALTER, elected member. 1921, i. 4.
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- SCOTT, W. W., JUN., on forged locomotive pistons. 1915, i. 588.
- SCOTT-HANSEN, A., on hydro-electric plants in Norway. 1911, ii. 593.
- SCOTT-YOUNGER, on welds. 1911, i. 105.
- SCRAGG, H., on manufacture of electrodes. 1918, i. 516.
- SCRIVENER, WALTER ALFRED, obituary notice. 1915, ii. 205.

- SCRIVENOR, J. B., on coal in the Malay States. 1912, ii. 482.
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- SEAGER, J. A., on dry-air blast. 1911, ii. 541.
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- SEAL, LEONARD, elected associate. 1917, i. 6.
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- SEAMAN, WILFRED ARTHUR, elected member. 1914, ii. xx.
- SEARLE, A. B., on analysis of clays and siliceous rocks. 1915, i. 634.
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- SEARLE, J. M., on smoke abatement. 1912, ii. 477.
- SEARS, J. D., on manganese ore in Costa Rica and Panama. 1920, ii. 310.
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- SEELY, F. B., on elastic strength of steel. 1920, ii. 382.
- SEELY, MAJOR-GENERAL, J. E. B., speech at Dinner by. 1919, i. 607.
- SEHMER, E. G., on a new form of electrically-driven rolling-mill. 1913, i. 86.
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- SEIBEL, C. W., on helium in natural-gas. 1917, ii. 372.
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- SEIDENSCHNUR, on recovery of tar from brown coal. 1921, ii. 354.
- SEIDL, K., on methods of working in collieries. 1911, ii. 529.
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- SIEGLE, J., on carbon consumption in blast-furnaces. 1920, ii. 343.
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- SELLARS, E. L., on colliery explosions. 1913, ii. 569.
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- SELWYN-BROWN, A., on coal in Japan. 1911, i. 544.
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- SEMENOFF, A., on petroleum in Russia. 1913, i. 553.
- SEMMES, D. R., on petroleum in Alabama. 1920, ii. 334.
- SEMPLE, C. C., on tempering drill steel. 1912, ii. 576.
- SEN, A. M., on estimation of coke in coal. 1911, i. 689.
- SÉNÉCHAL, A., on estimation of chromium. 1914, i. 747.
- SENIOR, GEORGE, obituary notice of. 1915, ii. 206.
- SESTER, C., on history of passivity of metals. 1914, i. 737.
- SEPULCHRE, FRANCOIS-JOSEF, obituary notice of. 1912, ii. 435.
- SERTZ, H., on iron crucibles. 1921, i. 472.
- SERVICE, T. M., on failure of boiler shell plates. 1914, i. 308.
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- SEVERIN, E., on analysis of petroleum. 1916, ii. 469.
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- SEYMOUR, W., on coking properties of coal. 1921, ii. 349.
- SHACKLETON, E., on use of liquid fuel. 1912, i. 477.
- SHACKLETON, H. R., on moulding in green sand. 1914, i. 664.
- SHADGEN, J. F., on blast-furnace practice. 1921, ii. 363.
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- SHANKS, J., on haulage in coal-mines. 1915, i. 536.
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- SHAPEL, L., on spontaneous combustion of coal. 1913, ii. 573.
- SHAPIRA, S., on magnetic concentration. 1915, i. 496.

- SHARLAND, G. A., on measurement of gases. 1919, ii. 472.
- SHARP, A., on long-wall methods of mining coal. 1914, i. 625.
- SHARP, R., on smelting foundry iron. 1915, i. 546.
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- SHARPLES, WILLIAM ELLISON, elected member. 1916, i. 4.
- SHAW, ALLAN MACKENZIE, elected member. 1917, ii. 4.
- SHAW, B., on casting propeller brackets. 1919, ii. 493.
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- SHAW, J., on foundry equipment. 1911, i. 597.
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- SHAW, J. B., on enamelling of iron and steel. 1921, i. 448.
- SHAW, JOHN K., elected associate. 1917, i. 6.
- SHAW, R. W., on natural-gas resources in Texas. 1916, i. 321.
- SHAW, W., on coal-dust in mines. 1916, ii. 414.
- SHAW, W. B., on coal-cutting machinery. 1912, i. 486; 1913, i. 571.
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- SHEARER, H. K., on bauxite in the United States. 1918, ii. 438.
- SHEEHAN, J. J., on heat-treatment of tool steel. 1913, ii. 641.
- SHEEL, EDGAR WILLIAM, elected associate. 1921, i. 6.
- SHELE, A. W. C., on high tensile steel for reinforcing concrete. 1917, ii. 443.
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- SHELLEY, J. W., on graphite in Madagascar. 1916, ii. 386.
- SHENFER, C., on partial demagnetisation of magnets. 1921, ii. 409.
- SHEPARD, E. R., on electrolysis of rails. 1920, i. 760.
- SHEPARD, W. K., on cold-rolling of steel. 1916, ii. 439.
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- SHEPARD, F. E., on concentration of ores. 1913, ii. 519.
- SHEPHERD, BENJAMIN FRANKLIN, elected member. 1919, i. 5.
- SHEPHERD, J., on disadvantages of oil-sand cores. 1915, i. 565.
- SHERBURN, H., on cupola practice. 1911, i. 592.
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- SHERIDAN, J. E., on coal in the United States. 1911, i. 547.
- SHERLOCK, C. C., on accidents in foundries. 1919, i. 660.
- SHERLOCK, R. L., on iron ore in England. 1919, ii. 458; 1920, ii. 306.
- SHERRICK, J. L., on coke manufacture. 1912, i. 471.
- SHERRY, R. H., on coarse crystallisation on annealing low-carbon steel. 1913, i. 647.
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- SHERRY, R. H., on influence of cold-working on crystallisation of steel. 1916, ii. 443.
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- SHILLITOE, HAROLD, elected member. 1914, i. 4.
- SHIMER, E. B., on estimation of titanium. 1912, ii. 625.
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- SHIMER, W. R., on heat-treatment. 1921, ii. 392.
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- SHIMOMURA, K., on by-product coke-ovens. 1916, i. 312.
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- SHIRLEY, J. G., on foundry patterns. 1916, i. 341.
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- SHOOK, G. A., on pyrometry. 1911, i. 538; 1912, i. 459, ii. 473; 1913, i. 533.
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- SHORE, ALBERT WILLIAM, elected member. 1920, ii. 5.
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- SHUFFLEBOTHAM, F., on sanitation in collieries. 1914, i. 634.
- SHURICK, A. T., on methods of working in collieries. 1911, ii. 529.
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- SIBLEY, F. H., on strength of welded and screwed pipe connections. 1917, ii. 439.
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- SIDDALL, F. N., on mine supports. 1915, i. 531.

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- SIEBERT, H., on electric resistance furnaces. 1911, ii. 590.
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- SIEDELL, R., on physical qualities of chrome steel. 1919, ii. 524.
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- SIEGLERSCHMIDT, H., on modulus of elasticity and thermal expansion of metals. 1912, i. 567.
- SIEMENS, F., on blast-furnace as sole source of power and fuel gas. 1918, ii. 463.
- SIEMIRADSKI, on ozokerite in Austria. 1914, i. 615.
- SIERRA, L., on explosions in collieries. 1911, i. 573.
- SIEVEKING, H., on pyrometry. 1914, i. 592.
- SIEVERTS, A., on solubility of hydrogen in copper, iron and nickel. 1912, i. 588.
- SIGAFOOS, M. H., on history of manufacture of wire ropes. 1918, ii. 489.
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- SILLARS, D., on basic slags. 1920, i. 722.
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- SILVER, L., on determination of volatile matter in coal. 1921, ii. 349.
- SILVERMAN, A., on a new microscope illuminator. 1920, i. 757.
- SIM, J., on origin of coal. 1912, i. 461, ii. 478.
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- SIMCOCK, E. O., on coal-dust experiments. 1911, ii. 533.
- SIMEON, C. J., on foundry casts. 1912, i. 525.
- SIMIDU, J., on thermal and electric conductivities of carbon steels. 1918, i. 549, ii. 504.
- SIMMERSBACH, B., on coal-mining in South Russia. 1915, i. 507.
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- SIMMERSBACH, O., on consumption of coke in blast-furnaces. 1917, ii. 389.
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- SINGTON, T., on reduction of tungsten. 1920, i. 675.
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- SINNATT, F. S., on agglutinating power of coal. 1920, i. 695.
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- SIROVICH, G., on metallography. 1920, ii. 385.
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- SISSON, on sand-blasting of castings. 1912, ii. 550.
- SISSONS, HERBERT, elected member. 1918, ii. 3.
- SISTERSON, GEORGE EDWARD, elected member. 1914, i. 4.
- SKAMEL, E., on annealing furnaces. 1914, i. 691.
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- SKARTVEDT, P. M., on estimation of phosphorus. 1914, i. 742.
- SKELTON, H. J., on rolling-mill practice at home and abroad. 1917, ii. 302.
- SKELTON, JOHN HERBERT, elected member. 1911, ii. 10.
- SKERRETT, R. G., on manufacture of nitric acid in United States. 1916, ii. 473.
- SKERRY, WHYBRO, elected member. 1918, i. 5.
- SKERTOHLY, S. A. R., on petroleum in Mexico. 1911, i. 556.
- SKIDMORE, WILLIAM, elected member. 1917, ii. 4.
- SKINKLE, W. B., on rolling-mill research. 1920, i. 729, ii. 369.
- SKINNER, C. E., on electro-percussive welding. 1915, i. 593.
- SKINNER, ORVILLE CAMPBELL, elected member. 1915, i. 2.
- SKLOVSKY, M., on fuel and combustion. 1921, i. 381.
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- SKOV, H., on furnaces heated by fuel oil. 1916, i. 319.
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- SLADE, R. E., on an electric vacuum furnace. 1913, i. 630.
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- SLADE, W. C., on preservative paints. 1912, ii. 615.
- SLADKY, A. C., on case-hardening. 1911, i. 630.
- SLATER, E. N. T., on manganese mining in India. 1920, ii. 310.
- SLATER, H. O., on manufacture of malleable iron-castings. 1915, i. 566.
- SLATER, J. M. L., on electric control gear for steelworks. 1913, i. 637.
- SLAWIK, P., on analysis of high-speed steel. 1920, ii. 397.
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- SLICK, E. E., on rolling solid steel wheels. 1918, ii. 480.
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- SMALES, CONRAD ALWYNE, elected associate. 1917, i. 6.
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- SMALLEY, O., on influence of cored dendritic structure in alloys. 1918, ii. 496.
- SMALLEY, W. M., on electro-analysis. 1911, i. 685.
- SMALLWOOD, J. C., on gas-producers. 1913, ii. 558.
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- SMALLWOOD, P. E., on working of thin seams. 1916, i. 325.
- SMART, B. J., on microstructure of steel. 1919, i. 691.
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- SMART, G., on economics of iron-ore mining. 1911, i. 530.
- SMART, R. C., on coal-dust sampling. 1921, ii. 421.
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- SMEETON, J. A., on blast-furnace gas purification. 1914, i. 334.
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- SMELLIE, JOHN, elected member. 1917, ii. 4.
- SMILEY, H. J., on heat-treatment of steel. 1918, i. 527.
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- SMITH, A., on moulding. 1917, ii. 398.
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- SMITH, A. W., on influence of temperature on Hall effect. 1913, ii. 678.
- SMITH, C. A. M., on impact testing. 1911, ii. 618.
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- SMITH, C. COLDIRON—
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- SMITH, C. G., on foundry equipment. 1911, i. 598.
- SMITH, C. H., on improvements in the case-hardening process. 1919, i. 403.

- SMITH, C. H., elected member. 1917, ii. 4.
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- SMITH, E. A., on iron ore in Alabama. 1913, ii. 504.
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- SMITH, E. F., on estimation of cobalt. 1916, i. 401.
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- SMITH, FRED, elected member. 1914, ii. xx.
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- SMITH, G. F., on analysis of materials. 1921, i. 472.
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- SMITH, SIR H. LLEWELLYN, speech at Dinner by. 1911, i. 491; 1913, i. 472.
- SMITH, H. R., on winding-ropes. 1917, i. 333.
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- SMITH, J., on electric cranes in steelworks. 1920, ii. 368.
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- SMITH, JAMES—
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- SMITH, J. A., on determining the density of flue-gases. 1917, i. 424.
- SMITH, J. CRUICKSHANK, on protective coatings for iron. 1913, ii. 692.
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- SMITS, A., on allotropy. 1915, i. 622.
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- SNELLING, W. O., on explosives and blasting. 1912, ii. 510.
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- SNYDER, T. E., on preservation of mine timber. 1913, i. 569.
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- SOBRERO, L., on heat-treatment of special steels. 1917, i. 384.
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- SOMMER, F., on by-product recovery. 1919, ii. 475; 1921, ii. 353.
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- SOMMERS, J. A., on Canadian rolling-mills. 1913, i. 640.
- SONE, T., on magnetic properties of iron. 1915, i. 617; 1916, i. 384.
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- SONNENFELD, J., on manufacture of steel castings. 1918, ii. 467.
- SOPER, E. K., on concentration of iron ore. 1911, i. 531.
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- on origin of ore deposits. 1912, i. 430.
- SOPWITH, S. F., on electric equipment of collieries. 1913, i. 570.
- SORBY, H. C., biographical notice of. 1920, i. 758.
- SORGE, K., on world's consumption of iron ore. 1913, i. 718.
- SOSMAN, R. B., on artificial and natural oxides of iron. 1918, ii. 430.

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- SOUTHER, HENRY, on alloy steels for motor-cars. 1911, i. 656; 1912, i. 587.
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- SOUZA, AGUILAR, F. M. DE. See AGUILAR, F. M. DE SOUZA.
- SOUZA-DANTAS, F. DE, on iron ores of Brazil. 1918, i. 472.
- SOWERS, D. W., on general foundry practice. 1917, i. 347.
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- SPEER, O., on testing of wire ropes. 1912, ii. 513; 1913, ii. 657; 1914, i. 627.
- SPEIGHT, R., on origin of petroleum. 1913, ii. 551.
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- SPENCE, H. S., on graphite in Canada. 1920, ii. 318.
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- SPENCER, A. C., on iron ore in Cuba. 1911, ii. 480.
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- SPENCER, C. B., on strength of iron at varying temperatures. 1915, i. 601.
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- SPENCER, L. J., on crystals of carbo-silicide of manganese and iron. 1918, i. 198.
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- SPENCER, RICHARD ELIAS EVANS, elected member. 1913, i. 4.
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- SPEER, F. W., on by-product coke-ovens. 1917, ii. 368; 1920, ii. 329, 330; 1921, i. 389.
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- SPITZER, F., on corrosion of iron. 1912, i. 597; ii. 611; 1913, ii. 691.
- SPRIET, C., on winding equipment. 1911, i. 568.
- SPRING, L. W., on high temperatures and physical properties of alloys. 1912, ii. 382.
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- SPROAT, I. E., on kaolin in the United States. 1917, ii. 357.
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- STADLER, H., on crushing of iron ore. 1915, i. 495.
- STAEHLE, A. M., on electric furnaces for steel foundries. 1918, i. 505.
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- STAGG, H. J., on hardening tool steel. 1915, i. 583.
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- STAHL, A. F., on petroleum in Russia. 1914, ii. 296.
- STAHLER, H., on gas-producers. 1917, ii. 378.

- STAHLSCHMIDT, J. H., on improvements in German blast-furnaces. 1911, ii. 546.
- STAINER, X., on geology of coal. 1916, i. 308.
- STALEY, H. F., on enamelling cast iron. 1920, i. 738.
on refractory research. 1921, i. 379.
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- STANDIFORD, E., on case-hardening of iron. 1918, i. 524.
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- STANDIFORD, W. S., on reinforcing bars from old rails. 1918, i. 520.
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- STANEK, V., on apparatus for the estimation of carbon, arsenic and sulphur in iron. 1911, i. 683.
- STANGE, A., on iron ore in Brazil. 1911, i. 522.
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- STANICHITCH, on estimation of manganese. 1912, i. 605.
- STANLEY, F. A., on grinding chilled rolls. 1912, ii. 570.
- STANLEY, G. H., on electric steel foundry in South Africa. 1918, i. 506.
- STANLEY, LIONEL WARNER, elected member. 1916, i. 4.
- STANSBIE, J. H., on electric furnaces. 1912, ii. 562 ; 1915, ii. 281 ; 1920, i. 719.
- STANSFIELD, A., on development of metallurgy and use of molybdenum in Canada. 1917, i. 288.
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on the iron-carbon system. 1914, i. 725.
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- STANSFIELD, E., on analyses of Canadian fuels. 1918, ii. 450.
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on storage and heating of coal. 1911, i. 574.
on testing of coke from Canadian coal. 1912, ii. 483.
- STANSFIELD, J., on formation of graphite. 1914, i. 590.
on petroleum in Canada. 1917, i. 321.
- STANTON, F. M., on analysis of coal and coke. 1912, ii. 627.
- STANTON, T. E., on fatigue of welded joints. 1912, i. 653.
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- STANTON, W. F., on tool-steel welding. 1911, i. 639.
- STAPLES, E. H., on geology of coal. 1917, i. 308.
- STAPLYTON, PHILIP MILES CHETWYND, elected member. 1918, i. 5.

- STAPNEWITCH, A., on natural-gas in Russia. 1913, i. 560.
 STARK, C. J., on history of vanadium. 1916, i. 298.
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 STASSART, S., on gases in collieries. 1911, i. 571.
 STATHAM, I. C. F., on coal-dust experiments. 1912, i. 489.
 STATHAM, N., on Bourcoud direct process. 1921, ii. 367.
 STAUBER, G., on motive power in foundry practice. 1914, i. 667.
 STAUCH, G., on corrosion. 1921, i. 469.
 STAUCH, K., on coal-dust experiments. 1913, ii. 571; 1914, i. 630.
 STEAD, FREDERICK ARNOLD, elected member. 1912, ii. 6.
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Paper: "Notes on nickel steel scale and on the reduction of solid nickel and copper oxides by solid iron." 1916, ii. 243.—*Discussion*: J. O. Arnold, 256; Dr. Stead, 257.

Paper: "Notes on the effect of blast-furnace gases on wrought iron." 1916, ii. 249.—*Discussion*: J. O. Arnold, 256; J. E. Stead, 257.

Paper on "Influence of some elements on the mechanical properties of steel." 1916, ii. 5; introduction, 5; definition of mechanical properties, 6; maximum stress, 7; elastic limit, 7; yield point, 7; elongation, 8; reduction of area, 8; annealing, 8; normalising, 9; tempering, 10; Section I: Pure iron and influence of carbon, 11; pure iron, 11; influence of carbon, 13; general laws, 34; normalising, 39; heat-treatment, 40; toughening, 40; summary and comments on Section I, 42; mechanical properties of pure iron, 42; influence of carbon on the properties of steel, 42; heat-treatment, 44; normalising, 44; hardening and tempering, 47; Section II: Influence of phosphorus 50; Terrenoire phosphoric steels, 51; shock tests, 51; mechanical properties of phosphoretic carbon steel, 59; conclusions, 63; summary and comments on Section II, 64; phosphorus in wrought iron, 66; Section III: Influence of sulphur and manganese, 66; experiments made during the present year (1916), 70; summary and comments on Section III, 72; Section IV: Influence of silicon, 75; summary and comments on Section IV, 79; Section V: Influence of copper, 80; copper-manganese steels, 83; copper-nickel steel, 83; summary and comments on Section V, 85; Section VI: Influence of tin, 86; summary and comments on Section VI, 89; concluding remarks, 90; Appendix, 91; influence of sulphur, 91; influence of silicon, 92; bibliography of literature on relations of chemical composition and physical properties of iron and steel, 95.—*Discussion*: Sir Robert A. Hadfield, 100; C. H. Ridsdale, 102; J. O. Arnold, 106; E. H. Saniter, 107; Sir John S. Randles, 109; W. Rosenhain, 110; F. W. Harbord, 111; C. J. Bagley, 113.—*Correspondence*: E. Adamson, 114; H. H. Ashdown, 115; L. Grenet, 117; M. Mannaberg, 122; C. P. Sandberg, 123; W. C. Unwin, 124; J. E. Stead, 125; H. M. Howe, 357; J. E. Stead (reply), 358.

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- STEAD, J. E., on defects in electro-deposited iron. 1920, i. 339.
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 on preparing sections of fractures for microscopical examination. 1913, ii. 390.
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 on relation between ball hardness and scleroscope hardness. 1918, ii. 80.

- STEAD, J. E., on relation between cutting efficiency and hardness of tool steel. 1916, i. 107.
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 on silica bricks. 1920, i. 682.
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- STEAD, J. E., and H. C. H. Carpenter—
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- STEAD, WILLIAM, elected member. 1920, i. 6.
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- STEBINGER, E., on coal in the United States. 1916, ii. 398.
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- STECK, E. H., on modern types of soaking pits. 1914, ii. 339.
- STEDMAN, H. G. A., on electric production of steel. 1912, i. 538.
- STEEL, A. A., on geology of coal. 1912, i. 462.
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- STEEL, GERALD, elected member. 1920, ii. 5.
- STEEL, HENRY, obituary notice of. 1920, ii. 304.
- STEEL, T., on corrosion of iron. 1911, i. 179.
- STEELE, H., on mine taxation. 1914, ii. 277.

- STEER, W. W., on electrical separation of tar from coal-gas. 1915, i. 517.
- STEERE, F. W., on producer practice. 1917, ii. 379.
- STEE, on cupola construction. 1911, i. 591.
- STEGEMANN, on shaft-sinking by the freezing process. 1912, ii. 508.
- STEIGER, E., on a kiln for burning magnesite. 1918, ii. 440.
- STEIGER, G., on precipitation of zirconium phosphate. 1919, i. 698.
- STEIN, CHARLES MARIE, elected member. 1914, i. 4.
- STEIN, A. H., on lighting fires in cupolas. 1913, i. 606.
- STEINBERG, S. S., on hardening hyper-eutectoid tool steel. 1914, i. 695.
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- STEINHAUS, W., on magnetic properties of freshly-heated dynamo plates. 1914, i. 713.
- STEINWEG, E., on phosphates in basic slag. 1912, i. 537.
- STELLA, A., on magnesite deposits in Italy. 1916, i. 302.
- STENGER, B. H., on fatigue of spring steel. 1921, i. 458.
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- STENGER, E. P., on exfoliation and carbon concentration in case-hardening of steel. 1917, i. 380.
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- STENGER, L. A., on corrosive action of soils on iron. 1920, ii. 394.
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- STEPHAN, E., on explosives. 1911, i. 526.
- STEPHAN, P., on tensile tests of material. 1911, i. 647.
- STEPHAN, W. G., on handling iron ore. 1911, i. 528, ii. 487.
- STEPHEN, S. W. B., on manufacture of foundry coke. 1911, ii. 560.
- STEPHENSON, HAROLD, elected associate. 1919, i. 7.
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- STERLING, P., on coal-screening. 1912, i. 492.
- STERNE, L., on desiccation of air by calcium chloride. 1911, i. 49, 52.
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- STEUART, D. R., on brown-coal distillation industry of Germany. 1917, i. 329.
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- STEUER, E., on cleaning of blast-furnace gases. 1912, i. 503.
- STEVEN, JOHANN CARL FERDINAND, elected member. 1914, i. 4.
- STEVENS, A. L., on lighting of collieries. 1911, ii. 535.
- STEVENS, ERNEST OSWALD, elected member. 1921, ii. 11.
- STEVENS, JOHN, obituary notice of. 1916, ii. 365.
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- STEVENS, P., on manganese ore output of the Caucasus. 1914, i. 763.
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- STEVENSON, J. J., on coal in France. 1911, i. 543.
- STEWART, J. G., on manufacture of wrought iron and steel tubes. 1915, i. 589.
- STEWART, JOHN WELSH, elected member. 1920, i. 6.
- STEWART, P. C. A., on petroleum in Mexico. 1914, ii. 300; 1915, ii. 245.
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- STEWART, R. J., on stresses in tubes. 1911, i. 649.
- STEWART, R. T., on strength of materials. 1912, i. 569.
- STEWART, VALENTINE BEARDMORE, elected member. 1913, i. 4.

- STEWART, WESLEY HACKWORTH, elected member. 1913, ii. 5.
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- STIG, THORSTEN GEORG, elected member. 1920, ii. 5.
- STIGAND, A. I., on origin of petroleum. 1920, i. 699.
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- STJERNBERG, C. GUSTAF, elected member. 1914, i. 4.
- STOBBS, J. T., on geology of refractory materials. 1920, i. 676.
- STOBER, A., on use of coke as boiler fuel. 1916, ii. 403; 1919, ii. 470.
- STOBIE, V., on electric furnace practice. 1912, ii. 560; 1915, i. 572; 1919, i. 666.
- STOCK, B., on tests of structural iron for bridges. 1912, ii. 588.
- STOCK, GEORGE JAMES, elected member. 1916, i. 4.
- STOCK, W., on oil-fired converters for foundries. 1912, i. 517.
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- STOKES, SIR F. WILFRID S., elected member. 1917, ii. 4.
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- STOKES, J. W. B., on large gas-engines. 1912, ii. 180.
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- STONE, S. R., on use of manganese steel for special purposes. 1913, i. 671.
- STONES, FRANK, elected member. 1921, ii. 11.
- STONES, HENRY, elected member. 1911, i. 4.
- STONES, R. W., on magnesite in the United States. 1918, ii. 439.
- STONEY, G., on conditions in engineering industry. 1916, ii. 473.
- STOPES, MARIE C., on constitution of coal. 1918, ii. 449; 1919, i. 637.
- STOPFORD, C. W., on instrument for indicating hardening temperature. 1920, ii. 373.
- STOREY, O. W., on annealing of malleable castings. 1915, i. 587.
on annealing of white iron. 1914, ii. 356.
on corrosion of steel ranges. 1921, i. 469.
on electrolytic iron. 1915, i. 621; 1916, ii. 463; 1917, ii. 456.
on manufacture of black-enamelled pipe. 1913, ii. 694.
on metallographic tests of steel. 1915, i. 620.
on methods of pickling. 1913, ii. 648.
on sheradising process. 1912, ii. 580; 1916, ii. 466.
- STORK, W. L., on oxygen in cast iron. 1919, ii. 516.
- STORM, C. G., on explosives. 1915, ii. 238; 1916, ii. 413.
- STORMS, W. H., on petroleum in California. 1912, ii. 497.
on search for iron ore. 1911, ii. 470.
on shaft-sinking. 1914, i. 621.
on use of rotary drill in working oil-wells. 1912, ii. 499.
- STOSE, G. W., on manganese ore in United States. 1920, ii. 310.
- STOTZ, R., on foundry laboratories. 1917, ii. 401.
on influence of phosphorus on grey cast iron. 1915, i. 595.
on malleable castings. 1916, ii. 425; 1920, ii. 389; 1921, i. 416, ii. 372.
on metallography in the foundry. 1921, ii. 412.
- STOUGHTON, B., on annealing steel castings. 1911, ii. 597.
on converters for steel foundries. 1911, ii. 563.
on corrosion of iron and steel. 1911, ii. 651.
on Gayley-Dwight-Lloyd sintering process. 1912, ii. 465.
on hardness tests. 1911, ii. 621.
on influence of high carbon on quality of charcoal iron. 1913, i. 658.
on influence of titanium on cast iron. 1912, ii. 583; 1913, i. 658.
on oil-fuel for cupola melting. 1916, i. 320, 339; 1917, i. 326.
on open-hearth furnace practice. 1912, ii. 554.
on production of sound ingots. 1914, i. 681.
on rail specifications. 1916, i. 383.
on Wittorff's iron-carbon equilibrium diagram. 1913, i. 681.
- STOUT, W., on coking coals. 1920, i. 694.
on manufacture of fire-bricks. 1913, ii. 526.
- STOUVENOT, A., on iron ore in France. 1920, i. 669.
- STOWE, C. B., on American refractories. 1921, ii. 340.
on synthetical reproduction of magnesio-ferrite ore. 1917, i. 297.
- STRACHAN, J., on winding appliances. 1912, i. 487.
- STRACHAN, JOHN E., elected member. 1915, ii. 2.
- STRACHE, H., on the Junkers calorimeter. 1915, i. 503.
- STRAHAN, SIR A., on cannel coal. 1919, i. 638.
on coal in the United Kingdom. 1915, ii. 233; 1918, ii. 450.
on iron ore in England. 1920, ii. 306.

- SUVERKROF, E. A., on electric steel furnace practice. 1918, ii. 474.
 on hardening and annealing furnaces. 1917, ii. 421.
 on heat-treatment of motor-car parts. 1915, ii. 295.
 on heat-treatment of railway axles and rods. 1915, i. 585.
 on production of shells. 1915, ii. 298; 1916, i. 364; 1919, ii. 493.
 on tests of axles. 1915, i. 609.
 on use of pulverised coal as fuel. 1914, ii. 286.
- SUZUKI, on iron and steel industry in Japan. 1919, i. 703.
- SVEDBERG, I., on coal in Sweden. 1913, ii. 538; 1914, i. 598.
- SWABEY, H. W. B., and R. GENDERS—
Paper on "The manufacture of shells in Canada during the war, 1914-18." 1921, i. 229; manufacture and form of product, 229; inspection and defects of shell steel, 240.
- SWAIN, P. W., on analysis of producer-gas. 1917, i. 424.
- SWAIN, R. E., on smoke abatement. 1921, ii. 347.
- SWALE, W. E., on rolling-mill drives. 1921, i. 432.
- SWAN, H. A., obituary notice of. 1912, i. 418.
- SWAN, H. B., on cleaning waste foundry sand. 1917, i. 350.
 on grey iron mixtures for motor-car castings. 1913, ii. 597; 1914, i. 659.
- SWAN, JOHN, elected associate. 1920, i. 7.
- SWAN, W. R., on protective coatings for iron and steel. 1914, i. 739.
- SWANDER, F. R., on manufacture of shells. 1919, i. 676.
- SWANN, T., on manganese ore in United States. 1919, i. 622.
- SWANNACK, FRANCIS, elected associate. 1917, i. 6.
- SWANSON, E. R., on steel foundry practice. 1919, i. 658.
- SWARTLEY, H. R., JUN., on oxy-acetylene welding. 1916, i. 366.
- SWEET-ESCOTT, ALDRED BICKHAM, elected member. 1921, i. 5.
- SWEETLEY, B. T., on acid resistance of enamelled utensils. 1921, ii. 415.
- SWEETSER, A., on blast-furnace practice. 1912, ii. 522.
- SWEETSER, R. H., on blast-furnace accidents. 1911, i. 587.
 on blast-furnace capacities. 1921, ii. 363.
 on blast-furnace operations. 1913, i. 582.
- SWEEZEY, R. O., on molybdenite in Quebec. 1913, ii. 510.
- SWIFFEN, CHARLES RANDOLPH, elected associate. 1920, i. 7.
- SWIFT, LOUIS JAMES, elected member. 1915, ii. 2.
- SWIFT, P., on a new microscope. 1920, i. 757.
- SWINDEN, THOMAS—
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"A study of the constitution of carbon-molybdenum steels, with an appendix on the mechanical properties of some low molybdenum alloy steels." C.S.M., 1913, v. 100; introduction, 100; recalescence curves, 101; description of cooling curves, 105; summary of observations on recalescence curves, 129; electrical resistivity, 131; microstructure of quenched specimens, 137; air-cooled specimens, 139; hardness tests of quenched specimens, 140; general discussion of results and their bearing on the constitution of molybdenum steels, 141; conclusions, 152; Appendix, 156.
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- SWINDEN, THOMAS, on hardening and tempering high-speed steel. 1915, ii. 43.
 on magnetic analysis as a means of studying the structure of iron alloys.
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 on tungsten and molybdenum steels. 1914, i. 727.
 awarded Carnegie Research Grant. 1911, i. 25.
 awarded Carnegie Gold Medal. 1914, i. 23, 24.
- SWOBODA, H. O., on electric heat-treatment furnaces. 1921, i. 437.
 on electric mine lamps. 1914, ii. 312.
- SWYNGADAW, on explosions in collieries. 1911, i. 574.
- SYKES, J. A., on care of electrical machinery in steelworks. 1913, i. 637.
 elected member. 1914, ii. xx.
- SYKES, R., obituary notice of. 1912, i. 418.
- SYKES, W., on comparison of types of electric furnaces. 1914, i. 680.
 on electric drive in steel mills. 1912, i. 528; 1913, i. 639; 1914, ii. 346;
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 on-power supply to electric furnaces. 1912, ii. 562.
 on steel-melting for foundries. 1914, i. 661.
 on winding machinery. 1915, ii. 223.
- SYMINGTON, ALEXANDER ORR, elected member. 1914, ii. xx.
- SYMONDS, B., on iron ore in Newfoundland. 1911, ii. 477; 1913, i. 511.
- SZADECZKY, J. VON, on natural-gas in Transylvania. 1911, ii. 520.
- SZAJNOCHA, on geology of petroleum. 1911, i. 552.
- SZASZ, E., on estimation of carbon in iron and iron alloys. 1913, ii. 697; 1915,
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 on estimation of manganese. 1917, i. 421.
 on estimation of nickel. 1914, i. 744.

T

- TABER, S., on growth of crystals under external pressure. 1916, ii. 462.
 on titanium deposits of Virginia. 1915, i. 489.
- TACZAK, S., on composition of coals. 1913, i. 536; 1914, ii. 286.
 on methods for analysing coals. 1913, i. 695.
 on purchase of fuel on a heat-unit basis. 1913, i. 534.
 on storage and heating of coal. 1911, ii. 537.
- TAFEL, W., on displacement of material during rolling. 1912, ii. 569.
 on plastic deformation of steel. 1914, i. 703.
 on heat-treatment. 1921, ii. 388.
 on use of waste heat. 1920, i. 722.
- TAFFANEL, J., on coal-dust experiments. 1911, i. 572; 1912, i. 489; 1913,
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 on explosives and blasting. 1911, i. 565; 1912, i. 443, 489.
 on utilisation of low-grade fuel. 1911, ii. 504.
- TAHON, V., on history of iron. 1911, i. 589.
- TAJI, Y., on microstructure of galvanised steel. 1920, i. 757.
 on tests on rivets. 1915, i. 601.
- TAKAGI, H., on critical points of iron. 1913, i. 678.
 on irreversibility of nickel steel. 1918, ii. 505.
 on magnetic properties of iron and iron alloys. 1913, ii. 677.
 on theory of invar. 1920, i. 755.
 on transformations of iron and steel at high temperatures. 1914, i. 719.

TAKAGI, H. (*continued*)—

Paper on "The cause of irreversibility of nickel steels." *See* HONDA, K.

Paper on "The magnetic transformation of cementite." *See* HONDA, K.

Paper on "The transformation of special steels at high temperatures."

See HONDA, K.

TALBOT, A. N., on tests of nickel-steel riveted joints. 1911, ii. 617.

TALBOT, B.—

Paper on "The production of sound steel by lateral compression of the ingot whilst its centre is liquid." 1913, i. 30; introduction, 30; use of deoxidisers, 32; casting and cooling of the ingots, 33; action of aluminium in solidifying the metal, 33; extent of segregation, 36; variation in composition of gas from ingots, 38; effect upon finished rail of lateral compression of the ingot whilst its centre is still liquid, 40; results of mechanical tests on flat-bottom rails, 47; mechanical tests on bull-headed rails, 47; commercial application of compression to ingots partially liquid in existing steelworks, 50; conclusions, 54.—*Discussion*: Sir Robert Hadfield, 56; A. Greiner, 58; H. Savage, 59; R. G. Scott, 61; F. W. Harbord, 62; J. M. Gledhill, 65; F. W. Paul, 66; E. H. Saniter, 67; C. J. Bagley, 68; A. Cooper, 68.—*Correspondence*: H. D. Hibbard, 69; Greville Jones, 70; F. Rogers, 72; B. Talbot (reply), 73.

Paper on "Modern open-hearth steel furnaces." 1913, ii. 232; introduction, 232; the Pencoyd tilting furnace, 233; comparison of tilting furnace with fixed furnace, 234; uses of tilting furnace, 236; rated capacities and dimensions of various furnaces, 238.—*Discussion*: T. C. Hutchinson, 240; A. E. Pratt, 240; O. Petersen, 241; A. Greiner, 242; Greville Jones, 243; T. Twynam, 243; A. Cooper, 245.—*Correspondence*: B. Talbot (reply), 245.

Paper on "Production of sound steel by lateral compression of the top portion of the ingot." 1918, i. 221; commercial application, 227.—*Discussion*: E. H. Saniter, 234; J. E. Stead, 234; Cosmo Johns, 234; W. H. Hatfield, 234; E. F. Law, 235; A. Hutchinson, 235; H. H. Ashdown, 235; F. Rogers, 235; B. Talbot (reply), 235.—*Correspondence*: S. W. Williamson, 237; B. Talbot (reply), 238.

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on open-hearth processes. 1914, i. 51.

on production of sound ingots. 1912, ii. 54; 1913, i. 631; 1915, i. 67.

on steel metallurgy. 1919, i. 192.

on use of pulverised coal. 1919, i. 120.

on welfare of the iron trade. 1916, i. 22.

TALBOT, F. A., on coal in Spitzbergen. 1911, ii. 508.

TALL, G. W., on heat-treatment of gears. 1920, ii. 373.

on hump method of heat-treatment. 1921, i. 440.

TALLENTS, RAYMOND ARTHUR, elected member. 1918, i. 5.

TALLEY, R. E., on electric furnaces for heat-treating. 1920, i. 730.

TAMMANN, G., on alloys of iron and zinc. 1914, i. 730.

on alloys of molybdenum and cobalt. 1914, i. 730.

on microstructure of meteoric nickel iron. 1911, i. 663.

on temper colours. 1921, i. 443.

on tensile tests of material. 1911, i. 647.

TARLETON, C. H., on explosions in collieries. 1911, ii. 534.

TARNAWIECKI, H. C., on occurrence of tungsten ore. 1911, ii. 483.

TARR, S. W., on working iron ore. 1914, i. 580.

TARRANT, A. G., on physical properties of refractories. 1920, i. 680.

- TARUGI, N., on utilisation of highly siliceous minerals. 1913, ii. 524.
- TASKER, J. H. R., obituary notice of. 1914, i. 557.
- TASSIN, W., on metallurgical microscopes. 1915, ii. 676.
on use of microscope in inspection of material. 1913, ii. 676; 1914, i. 716.
- TATE, S., on electricity in mines. 1911, i. 566.
on history of the safety-lamp. 1917, ii. 385.
- TATE, T. R., on waste-heat boilers. 1921, i. 398.
- TATHAM, T., obituary notice of. 1911, i. 500.
- TAUDEVIN, E. P., on the use of town-gas as furnace fuel. 1917, ii. 381.
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- TAUSSIG, J. H., on refractory problems. 1920, i. 678.
- TAVANTI, G., on case-hardening. 1911, i. 629; ii. 594.
on malleable cast iron. 1911, i. 605.
on solubility of slag inclusions in molten steel. 1915, i. 618.
- TAWARA, KUNICHI—
Paper on "The transformation of special steels at high temperatures."
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elected member. 1919, ii. 4.
- TAWARA, K., and G. ASAHARA—
Paper on "Graphitisation in iron-carbon alloys." 1919, i. 565; introduction, 565; experiments, 565.—*Correspondence*: E. Adamson, 581; J. E. Fletcher, 582.
- TAYLOR, C. A., on estimation of nitrogen in coal. 1915, i. 635; 1916, ii. 469.
- TAYLOR, C. P., on iron ore in New York. 1913, i. 514.
- TAYLOR, G., on recovery and rectification of benzene. 1916, i. 314.
- TAYLOR, GEORGE—
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on reform in the file industry. 1918, ii. 509.
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- TAYLOR, G. B., on apparatus for analyses of complex gas mixtures. 1915, i. 636.
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on specific heat of coal. 1913, ii. 537.
- TAYLOR, H. N., on manufacture of drop-forging steel. 1916, ii. 436.
- TAYLOR, PHILIP STANLEY, elected member. 1918, ii. 4.
- TAYLOR, R. M., on steel for machine parts. 1921, i. 442.
- TAYLOR, S. A., on coal-cutting machines. 1914, i. 624.
- TAYLOR, T. S., on hot-wire anemometer. 1920, i. 685.
- TAYLOR, W. A., on prevention of underground fires. 1913, i. 575.
- TAYLOR, W. E., on electric driving of rolling-mills. 1921, i. 433.
- TAYLOR, W. W., on pyrites cinder in blast-furnaces. 1917, i. 339.
- TEASDALE, THOMAS BONNOR, elected member. 1919, i. 5.
- TEED, P. L., on estimation of moisture in coal. 1913, ii. 708.
- TEGENGREN, F. R., on occurrence of chromite in Sweden. 1913, ii. 509.
- TEICHMANN, H., on uses of petroleum. 1911, ii. 518.
- TEICHMULLER, J., on power from peat-gas. 1912, ii. 505.
- TELFER, W. H., on production and transmission of power in collieries. 1913, ii. 565.

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Paper on "Phosphorus in malleable cast iron." 1918, ii. 349; preliminary, 349; microscopic examination of casts before annealing, 352; mechanical testing of annealed bars, 354; tensile tests, 354; transverse tests, 354; bending tests, 354; hardness tests, 355; Izod impact tests, 358; microscopic examination of the annealed bars, 361; appearance of fractures of the bars used for bending and transverse tests, 362; copper deposition examination, 364; presence of sulphide of iron in spent ore, 365; conclusions, 367; references, 367.—*Discussion*: E. Adamson, 368; W. H. Hatfield, 369; J. H. Teng (reply), 369.
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TENNENT, J., obituary notice of. 1911, ii. 458.

TENNYSON, C., on fuel economy. 1919, ii. 101.

TERADA, A., elected member. 1918, i. 5.

TERANO, S., on uses of petroleum. 1911, ii. 518.

TERBECK, on winding appliances. 1913, ii. 568.

TERMAN, J. E., on deformation of welded drums. 1914, ii. 371.

TERNI, A., on estimation of chromium. 1913, ii. 707.

TERREAULT, J., on malleable cast iron. 1911, i. 605.

TERRELL, E., on Hemerdon wolfram mine on Dartmoor. 1920, i. 675.

TERRES, E., on composition of coal. 1915, i. 506.

on reactions in blast-furnace equilibrium. 1920, ii. 343.

TERRONES, A., on mineral resources of Durango. 1921, ii. 336.

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THALER, H., on blast-furnace reactions. 1917, ii. 390.

on calculation of oxygen in blast-furnace gas. 1920, i. 707.

on chemistry in the foundry. 1911, i. 593.

on classification of foundry iron by analysis. 1911, ii. 560.

on foundry laboratories. 1911, i. 606.

on influence of nickel on structure of pig iron. 1912, ii. 583.

on smelting of manganiferous ore. 1915, i. 547; 1921, i. 402.

THAMM, on peat. 1911, ii. 511.

THAU, A., on by-product recovery. 1913, i. 548; 1921, i. 388.

on crushing coking coal. 1915, i. 517.

on coke quenching appliances. 1921, i. 388.

on coking accessories. 1911, ii. 512; 1913, i. 549.

on coking practice. 1911, ii. 512; 1921, i. 387.

on determination of benzol in coke-oven gas. 1921, ii. 421.

on distillation of coal. 1914, ii. 294.

- THAU, A., on mechanical handling of coke. 1914, i. 607.
 on tar-washing. 1920, ii. 329.
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- THAYER, H. R., on causes of failure in engineering structures. 1913, ii. 664.
- THEARLE, SAMUEL JAMES POPE, obituary notice of. 1913, ii. 481.
- THEIN, H., on cleaning of blast-furnace gases. 1921, ii. 364.
- THEISEN, E., obituary notice of. 1911, i. 500.
- THEISEN, HANS EDUARD, elected member. 1912, i. 4.
- THELE, W., on chains for ships' anchors. 1912, i. 554.
- THEYS, ALFRED, elected member. 1911, ii. 11.
- THICKENS, DAVID, elected member. 1919, i. 5.
- THIEL, G., on microscopy of coal. 1914, i. 57.
- THIEL, O., on Bessemer steel plant and practice. 1917, ii. 405.
- THIELE, H., on calorimetric determination of value of fuels. 1913, ii. 531.
- THIEME, H., on electric furnace in steel foundry practice. 1911, i. 624, ii. 564.
 on transport arrangements of Italian steelworks. 1913, ii. 618.
- THIESSEN, R., on microstructure of coal. 1914, ii. 288; 1921, i. 385.
 on origin of coal. 1912, ii. 478; 1914, ii. 287.
 on sulphur in coal. 1920, i. 691.
- THIRY, G., on sanitation in iron-ore mines. 1913, ii. 517.
- THIRY, H., on manufacture of coke. 1914, i. 603.
- THOM, GEORGE, elected member. 1921, i. 5.
- THOMAS, on design of open-hearth furnaces. 1920, i. 714.
- THOMAS, A., on manufacture of ball-bearings. 1918, ii. 488.
- THOMAS, ALBERT, elected member. 1919, i. 5.
- THOMAS, ALFRED JOHN LESLIE, elected associate. 1919, i. 7.
- THOMAS, A. S., on manufacture of open-hearth steel. 1912, ii. 116.
- THOMAS, B. H., on electrolytic deposition of iron. 1920, i. 738, ii. 393
- THOMAS, C., on special castings. 1917, ii. 400.
- THOMAS, C. C., on blast-furnace gas meters. 1911, ii. 544; 1912, i. 501.
- THOMAS, C. H., on electro-plating with cobalt. 1915, ii. 327.
- THOMAS, F., on methods of steel production. 1921, i. 419.
- THOMAS, G. W., on coal-cutting machines. 1912, ii. 519.
- THOMAS, H. H., on refractory materials. 1920, ii. 316.
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- THOMAS, H. S., on McKune open-hearth port. 1921, i. 418.
 on recent developments in the tinplate industry. 1913, i. 654.
 on statistics of tinplate industry. 1913, i. 719.
- THOMAS, HUBERT ALAN SPENCE, elected member. 1921, ii. 11.
- THOMAS, JOHN HENRY, elected member. 1911, i. 4.
- THOMAS, J. J., on hardness tests. 1914, ii. 369.
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 on tension tests of nickel steel. 1921, i. 456.
- THOMAS, K., on blue billy in United States. 1920, ii. 314.
 on uses of spent oil shale. 1921, i. 393.
- THOMAS, L., on continental foundries. 1911, i. 598.
- THOMAS, L. M., on heat-treatment of automobile axles. 1921, i. 437.
- THOMAS, P., on destruction of French steelworks. 1920, ii. 362.
- THOMAS, R. D., on Moore electric furnace. 1921, i. 425.

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on oil-fields of Russia. 1921, i. 392.

THOMPSON, A. M., on economical manipulation of foundry sand. 1915, i. 564.

THOMPSON, F. C.—

Paper on "Surface tension effects in the intercrystalline cement in metals and the elastic limit." 1916, i. 155; introduction, 155; static stresses, 159; dynamic stresses, 170; electrical and magnetic properties 176; effects of temperature on the mechanical properties of metals, application of the theory to iron and steel, 180; summary, 191.—*Discussion*: J. O. Arnold, 194; W. Rosenhain, 196; J. E. Stead, 199; T. Turner, 201; W. H. Hatfield, 202; E. H. Saniter, 203.—*Correspondence*: J. E. Fletcher, 204; H. Howe, 205; F. C. Thompson (reply), 206.

Paper on "The influence of surface tension upon the properties of metals, especially of iron and steel." 1917, i. 155; some effects of surface tension on steel, 166.—*Correspondence*: W. H. Hatfield, 175; W. Rosenhain, 177; F. C. Thompson (reply), 184.

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on elastic strength of metals. 1915, i. 600; 1916, i. 373.

on hardness measurement. 1920, i. 741.

on measuring colour of metals and alloys. 1914, ii. 381.

on the metal mixer. 1915, ii. 262.

on photomicrography. 1920, i. 757.

on Roentgen spectrographic investigations of iron and steel. 1921, i. 332.

on surface tension effects in high-speed steels. 1919, i. 429.

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THOMPSON, GEORGE RUDD, elected member. 1916, i. 4.

THOMPSON, G. W., on preservation of iron. 1911, i. 678.

THOMPSON, H. E., on foundry patterns and moulding. 1912, i. 518.

THOMPSON, H. V., on analysis of zirconium. 1921, i. 472.

on dissociation of salt. 1918, i. 476.

THOMPSON, J., obituary notice of. 1911, ii. 458.

THOMPSON, J., on sources of oil supply. 1917, ii. 372.

THOMPSON, J. F., on corrosion. 1921, i. 470.

THOMPSON, J. L., on transformers for electric furnaces. 1920, i. 720.

THOMPSON, J. W., on mining law in the United States. 1916, i. 300.

THOMPSON, JOHN WILLIAM, elected member. 1911, i. 4.

- THOMPSON, M. DE K., on brittleness produced in steel springs by electro-plating. 1917, i. 402.
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on pyrophoric alloys. 1918, i. 548.
- THOMPSON, N. J., on steel for automobile parts. 1920, i. 746.
- THOMPSON, S. P., on steel for permanent magnets. 1913, ii. 679; 1915, i. 616.
- THOMPSON, THOS. G.—
Paper on "Preservation of iron and steel by means of passivating factors." **C.S.M.**, 1916, vii. 232.
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- THOMPSON, WILLIAM HERBERT, elected associate. 1917, i. 6.
- THOMSON, J. B., on signalling in collieries. 1917, i. 334.
- THOMSON, J. C., on corrosion of iron. 1911, i. 674; 1912, ii. 609.
- THOMSON, THOMAS, elected member. 1921, ii. 11.
- THOMSON, T. FRAME, obituary notice of. 1913, ii. 482.
- THONET, C., on gas-producers. 1911, i. 559.
- THONNART, on impregnating mine timber. 1915, i. 531.
- THORNE, C. A., on electric smelting of iron ore. 1913, i. 594.
- THORNE, J. L., on heat-treatment of tool steel. 1918, ii. 484; 1921, i. 441, ii. 390.
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- THORNEYCROFT, W., on consumption of fuel in iron and steel manufacture. 1920, i. 689.
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- THORNTON, H. M., on heat-treating furnaces. 1920, ii. 371.
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- THORNTON, W., on gases in mines. 1914, i. 632.
- THORNTON, W. M., on coal-dust experiments. 1911, i. 572, 573, ii. 534; 1912, i. 489, ii. 516; 1913, ii. 571; 1914, ii. 312.
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- THORNTON, W. M., JUN., on estimation of titanium. 1912, ii. 625; 1914, ii. 395.
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on separation of zirconium from iron and titanium. 1914, ii. 395.
on use of electricity in coal-mining. 1914, ii. 308.
- THORP, J., on by-product recovery. 1919, ii. 475.
- THORVALDSON, T., on atomic weights of metals. 1911, i. 670.
- THRASHER, G. M., on influence of natural chill on malleable castings. 1915, i. 596.
- THUM, E. E., on flakes in steel. 1919, ii. 523.
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- THUNBLOM, A., on haulage of iron ore. 1912, i. 445.
- THURINGER, V., on estimation of palladium in iron. 1913, ii. 702.
- THURMAN, J. B., on gates for moulds. 1913, i. 611.
- THURSFIELD, F., on electric driving of rolling-mills. 1911, i. 610.
on winding equipment. 1911, i. 568.
- THURSTON, G. H., on low and high temperature carbonisation. 1921, i. 390.

- THWAITE, A. H., on moisture in coal. 1921, i. 386.
- THWAITES, F. T., on iron ore in Wisconsin. 1914, ii. 269.
- THWAITES, RICHARD ALAN STUART, elected member. 1918, i. 6.
- THWING, C. B., on measurement of temperature by electrical means. 1913, ii. 532, 533.
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- TIDDEMAN, R. H., on coal in Wales. 1918, ii. 450.
- TIDESWELL, F. V., on constitution of coal. 1920, ii. 324.
- TIDMAN, C. F., on alcohol from coke-oven gas. 1921, i. 389.
- TIDSDALL, ALFRED DOUGLAS, elected member. 1911, i. 4.
- TIEMANN, HEINRICH, elected member. 1914, i. 4.
- TIEMANN, H. P., on changes produced in steel by annealing. 1914, ii. 358.
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- TILLSON, B. F., on heat-treatment of rock-drill steel. 1921, i. 442.
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- TILSCHKEET, V., on armour plate manufacture. 1911, i. 640.
- TILT, E. B., on chilled car wheels. 1914, ii. 332.
- TILTON, A. M., on drop-forging. 1915, ii. 296.
- TIMMINS, A. C., on properties of cast iron. 1920, ii. 379.
- TIMMINS, ALBERT EDWARD, elected member. 1920, ii. 5.
- TIMMIS, G. H., on fireclay bricks. 1917, ii. 353.
- TINGBERG, O., on Ljungberg's system of charcoal burning. 1915, i. 513.
- TINSLEY, J. F., on heat-treatment of wire. 1914, ii. 356.
- TINSLEY, MATTHEW RALPH, elected member. 1919, i. 5.
- TISSIER, L., on carbonisation of wood. 1921, i. 386.
- TITUS, on deep boring. 1914, i. 580.
- TOCH, M., on protective coatings for iron and steel. 1915, ii. 326.
- TOFTS, CROZIER FULLERTON, elected member. 1914, i. 4.
- TOLADAY, R. E., on mineral statistics of Cuba. 1911, ii. 673.
- TOLMAN, C. F., on nickel ores of Sudbury. 1917, i. 287.
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- TOLPUTT, HERBERT, elected member. 1913, ii. 5.
- TOMKINS, HENRY, obituary notice of. 1916, i. 276.
- TOMLINSON, NOEL LLEWELYN, elected member. 1920, ii. 5.
- TOMLINSON, T., on power from peat-gas. 1912, ii. 506.
- TOMLINSON, T. A., on manufacture of coal-gas. 1921, i. 395.
- TONAMY, C. H., on examination of castings by means of X-rays. 1915, ii. 272.
- TONE, F. J., on electric furnace products. 1916, ii. 430.
on refractory properties of carborundum. 1914, i. 589.
on "silicidized carbon-silfrax." 1915, i. 502.
- TONGE, A. J., on explosions in collieries. 1911, i. 574.
- TONGE, J., on uses of the hydraulic mining cartridge. 1915, i. 535.
- TOOKEY, W. A., on gas-engines. 1914, i. 620.
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- TORNOW, on coal-dust explosions. 1914, i. 629.
- TORON, J., on fuel tests. 1914, i. 593.
- TOROSSIAN, G., on the reduction test for tungstic acid. 1915, i. 633.
- TOUCEDA, E., on fracture of malleable iron. 1917, i. 353.
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- TOUCEDA, E., on manufacture and properties of malleable castings. 1913, ii. 605; 1914, ii. 332; 1915, i. 596, ii. 272, 273; 1918, i. 503; 1919, ii. 494; 1920, ii. 352, 389; 1921, i. 416.
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- TOUR, R. S., on gas analysis. 1921, i. 473.
- TOUZALIN, L. A., on safety appliances at blast-furnaces. 1921, i. 402.
- TOWL, F. M., on transport of petroleum. 1915, ii. 246.
- TOWNS, H. L., on welding. 1918, i. 529.
- TOWNSEND, C. D., on utilisation of waste heat from iron melting furnaces. 1918, i. 501.
- TOWNSEND, D., on operation of cupolas. 1915, i. 559; 1916, i. 338.
- TOY, F. L., on basic open-hearth process. 1921, i. 419.
- TOY, H. B., on electrically-driven rolling-mills. 1913, i. 87.
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- TOY, SIDNEY VICTOR, elected member. 1920, i. 6.
- TOZER, WILLIAM, JUN., elected member. 1920, ii. 5.
- TRABOLD, F. W., on use of drop-forgings for motor-car parts. 1913, i. 648.
- TRACEY, B. C., on arc welding. 1921, ii. 394.
- TRAER, G. W., on low temperature carbonisation of coal. 1919, i. 641.
- TRASENSTER, E., on Belgian iron industry. 1920, ii. 361.
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- TRASENSTER, G.—
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- TRAUTSCHOLD, R., on gas-producers. 1913, i. 563, ii. 558.
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- TRAVERS, H., on estimation of manganese and chromium. 1917, ii. 464.
- TRAVERS, M. W., on tensile strength of refractories. 1921, i. 378.
- TRAVIS, HENRY EDWARD, elected member. 1921, i. 5.
- TREGONING, WILLIAM EDWARD CECIL, elected member. 1918, ii. 4.
- TRELLON, M., on ventilation in collieries. 1911, ii. 532.
- TREISCHER, C., on enamelling steel. 1919, i. 681.
- TRENKLER, H. R., on carbocite. 1921, ii. 353.

- TRENKLER, H. R., on fuels for gas-producers. 1914, ii. 305.
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- TRENTZL, A., on petroleum in Russia. 1912, ii. 495.
- TREUHEIT, J., on foundry costs. 1916, i. 343.
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- TREUHEIT, L., on converters for steel foundries. 1919, ii. 490.
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- TREVELYAN, FREEMAN, elected member. 1915, i. 2.
- TREVOR, T. G., on manganese ore in South Africa. 1919, ii. 461.
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- TRILLAT, A., on manufacture of ferro-cerium. 1919, i. 668.
- TRIMLETT, HENRY J., elected member. 1917, i. 4.
- TRINKS, W., on air-pressure in Bessemer converters. 1917, ii. 405.
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- TRIPPIER, on use of steel turnings in blast-furnace. 1919, ii. 483.
- TRIPLETT, W. H., on mechanical properties of ternary steels. 1913, i. 674.
- TRIPP, G., on manganese steel for heavy rolling-mill equipment. 1915, ii. 290.
- TRIS, P. C., on tests of welded bars. 1920, i. 744.
- TROELLER, on Dwight-Lloyd briquetting process. 1914, i. 586.
- TROOD, S., on heat-treatment of die-blocks. 1921, ii. 387.
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- TROPENAS, ALEXANDRE, obituary notice of. 1915, ii. 206.
- TROPSCH, H., on composition of tars. 1921, ii. 354.
- TROTT, THOMAS, elected member. 1914, ii. xx.
- TROUBINE, K., on blowholes in steel ingots. 1912, i. 559.
- TROUBINE, KONSTANTIN GEORGIEVITCH, elected member. 1912, ii. 6.
- TROUT, G. H., on producer-gas for heat treating. 1921, i. 437.
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- TROWBRIDGE, A., on special castings. 1912, i. 522.

- TRUBEY, GEORGE, elected member. 1915, i. 2.
- TRUBSHAW, HAROLD ERNEST, elected member. 1914, i. 4.
- TRUMBULL, H. N., on gas-producer practice. 1920, ii. 340.
- TRUMPER, THOMAS WILLIAM WALWYN, elected member. 1919, i. 5.
- TRURAN, EDWARD, elected member. 1918, i. 6.
- TRÜSTEDT, O., on search for iron ore. 1912, ii. 447.
- TRYON, CLAUDE, elected member. 1913, ii. 5.
- TRYON, F. G., on fluctuations in coal production. 1920, ii. 342.
- TSCHEK, on separation of iron, chromium and aluminium. 1911, i. 683, ii. 662.
- TSCHERNOBAEFF, D., on heat-formation of silicates. 1912, i. 589.
- TSCHERNOFF, D. K., obituary notice of. 1921, ii. 326.
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- TSCHISCHIEWSKI, N.—
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- Paper* on "The case-hardening of iron by boron." 1917, i. 185.
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- TSCHISCHIEWSKI, N., and N. SCHULGIN—
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- TSCHITSCHIBABIN, A. E., on origin of petroleum. 1915, ii. 242.
- TSCHUGAEFF, L., on colorimetric method for determination of iron. 1915, i. 633.
- TSICHEVSKI, A., on methods of coal-mining in Russia. 1913, i. 572.
- TÜBBEN, L., on gases in coal-mines. 1911, ii. 533.
- TUCAN, F., on bauxite. 1913, i. 529.
- TUCKER, A. E., on brazing of cast iron. 1912, ii. 578.
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- TUCKER, S. A., on laboratory furnaces. 1917, ii. 466.
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- TUCKWELL, H. M. S., on the iron and steel industry of India. 1918, i. 558.
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- TULLOCH, T. G., on wear in guns. 1921, ii. 401.
- TUNGAY, S., on acid-resisting iron. 1918, i. 544.
- TUNISON, R. R., on manufacture of alcohol. 1921, i. 389.
- TUPPER, C. A., on blast-furnace linings. 1913, ii. 576.
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- TURNBULL, J. A., on winding-engines. 1914, ii. 310.
- TURNBULL, N. K., on hot-galvanising. 1914, i. 700.
- TURNBULL, R., on electric smelting of iron ore. 1918, i. 495 ; 1919, i. 649.
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- TURNBULL, WILLIAM GOVER, elected member. 1920, ii. 5.
- TURNER, F. M., JUN., on chemical and metallurgical technology of vanadium. 1915, ii. 318.
- TURNER, G., on bloom of Roman iron found at Corstopitum. 1912, i. 131.
- TURNER, L. B., on elastic limit of iron and steel. 1911, ii. 613.
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 on diffusion of carbon in iron. 1915, i. 269.
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 on facts regarding carbon and iron. 1916, i. 338.
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 on Indian iron and steel of ancient origin. 1912, i. 185.
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 on influence of temperature on carbon and pig iron. 1911, ii. 105.
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- TURNER, T., on malleable cast iron. 1919, i. 660.
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on properties of refractory materials. 1917, i. 59.
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on relation between cutting efficiency and hardness of tool steel. 1916, i. 108.
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on volume changes in cast iron during cooling. 1911, i. 642; 1912, i. 555.
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- TURNER, THOMAS HENRY, elected associate. 1921, i. 6.
- TURNER, W. A., on estimation of vanadium. 1916, ii. 468.
- TURNER, W. E. S., on British fireclays. 1921, ii. 340.
- TURNOCK, JOHN MEYRIC, elected member. 1921, ii. 11.
- TURPIN, F. T., on hand ball-hardness testing machine. 1915, ii. 308.
- TURQUAND, F. J., on detection of fire-damp in mines. 1914, ii. 312.
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- TURBENTINE, J. W., on application of ammonia. 1917, i. 316.
- TURTON, FRANK, elected member. 1912, i. 4.
- TURTON, JOHN, obituary notice of. 1912, i. 418.
- TURTON, JOHN ALBERT, elected member. 1912, ii. 7.
- TUSKER, H., on estimation of chromium in steel. 1915, i. 632.
- TUTTLE, F. H., on estimation of phosphorus. 1913, ii. 700.
- TUTWILER, C. C., on manufacture of cyanides from coal-gas. 1915, i. 516.
- TWEEDIE, THOMAS CHALMERS, elected associate. 1917, ii. 5.
- TWEEDY, A. M., on Schumacher briquetting process. 1914, i. 586.
- TWEEDY, GEORGE FREDERICK, elected member. 1917, i. 4.
- TWELVETREES, W. H., on oil shale in Tasmania. 1913, i. 557.
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- TWOMEY, T. J., on analysis of petroleum. 1915, ii. 335.
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- TWYNAM, T., on development of the Talbot process. 1914, i. 91.
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- TYLER, P. M., on chain industry of Great Britain. 1921, i. 446.
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- TYSHNOFF, VSEVOLOD, elected member. 1915, i. 2.
 TYSSOWSKI, J., on internal combustion mine locomotives. 1913, ii. 567.

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- UBBELOHDE, L., on refining petroleum. 1913, ii. 554.
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 UDDEN, J. A., on coal in Illinois. 1912, ii. 485.
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 UDHAUG, A., on coal in Spitzbergen. 1912, ii. 481.
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 UDHAUG, A. D., on progress of Swedish iron industry. 1915, i. 650.
 UDOWIS-ZEWSKI, H., on analysis of magnesite. 1915, i. 634.
 UEHLING, on blast-furnace operations. 1911, i. 580.
 UEHLING, E. A., on carbon dioxide recorders. 1912, i. 460.
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- UPTON, ALFRED ERNEST, elected member. 1917, ii. 5.
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- VAHLE, M., on mine drainage. 1915, i. 535.
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 VALENTINE, S., on constitution of the atom. 1921, ii. 414.
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 VANDELEUR, HENRY MARTLEY, elected member. 1919, i. 5.
 VAN DEN BROEK, J. A.—
Paper on "Effects of cold-working on the elastic properties of steel."
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 VANDERHOOF, H., on Canadian iron and steel industry. 1916, i. 403.
 VAN DER STRAETEN, BARON FERNAND, elected member. 1914, i. 4.
 VANDERSTRICK, ALBERT, elected member. 1914, i. 4.
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VAUGHAN, F. P., on electric welding. 1921, i. 445.

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VEIT, T., on ferro-magnetic compounds of manganese. 1912, i. 578.

VELA, MANUEL, elected member. 1921, i. 5.

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VENABLE, F. P., on atomic weight of zirconium. 1917, ii. 356.

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VENATOR, W., on oil-fired furnaces for foundries. 1912, ii. 543; 1913, ii. 599.

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- VICARS, E. R. E., on coal in France. 1914, ii. 288.
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- WALTON, JOHN SPILMAN, elected associate. 1920, i. 7.
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- WATSON, T. L., on crystallography of manganese ores. 1919, i. 623.
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- WAY, A. B., on hydrogen-sulphide in gas. 1915, i. 636.
- WAY, H. W. L., on petroleum in China. 1916, ii. 405.
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- WEAVER, C. E., on petroleum in the United States. 1915, ii. 244.
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- WEBB, J. J., on small steel ingots. 1920, ii. 364.
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- WEDGWOOD, G. A.—
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- WEEKS, H. B., on preservation of iron. 1920, i. 759.
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- WEISS, L., on temperature of formation of titanium dioxide. 1912, i. 590.
- WEISS, P., on magnetic properties of nickel and cobalt alloys. 1912, ii. 382, 599.
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- WEISSENBERG, B., on cupola blōwers. 1914, i. 657.
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- WELLS, GEORGE WILLIAM, elected member. 1919, i. 6.
- WELLS, R. C., on brannerite. 1920, i. 675.
on chemistry of ore deposition. 1916, i. 288.
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- WELLS, W. H., on heat-losses in electric furnaces. 1916, i. 347.
- WELTER, JEAN C., elected member. 1914, ii. xxi.
- WEMPLINGER, J. R., on galvanising. 1921, i. 449.
- WENCÉLIUS, A., on analysis of coal. 1913, i. 695.
on calorific value of fuels. 1912, ii. 472.
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- WENDEBORN, B. A., on iron ore in Servia. 1912, ii. 449.
- WENDEL, F. DE, on iron ore deposits of France. 1921, ii. 56.
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- WENDELL, G. V., on pyrometry. 1920, i. 688.
- WENDRINER, on haulage in collieries. 1912, i. 488.
- WENNEMANN, A., on estimation of sulphur and carbon. 1912, i. 604.
- WENTWORTH, F. H., on foundry fires. 1917, i. 359.
- WENTWORTH, H. A., on concentration of ore. 1912, ii. 463.
on magnetic separation of iron ore. 1911, i. 533.
- WENTZ, J. A., on mine surveying. 1912, i. 491.
- WEFFER, G. W., on tungsten deposits of Bolivia. 1914, ii. 273.
- WERCKMEISTER, C., on rolling-mills for axles. 1912, ii. 571.
- WERNER, A., on linear expansion of metals. 1913, ii. 650.
- WERNER, S. W., on defects in steel ingots. 1918, ii. 478.
- WERNICKE, F., on firebricks. 1913, i. 527; 1920, i. 683.
- WESCOTT, G. F., on rust-proof coating. 1917, i. 418.
- WESSELMANN, J., on composition of blast-furnace gases in relation to furnace working. 1914, ii. 320.
- WESSON, C. M., on steel castings for ordnance construction. 1918, i. 504.
- WESSON, WILLIAM, elected member. 1920, ii. 6.

- WEST, A., on blast-furnace gas-engines. 1913, ii. 563.
 on gas-driven blowing engines. 1915, ii. 260.
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- WEST, C. J., on electric furnace practice. 1920, i. 718.
- WEST, F. J., on manufacture of coal-gas. 1921, i. 595.
- WEST, GEORGE PHILIP, elected member. 1921, i. 5.
- WEST, J., on distillation of coal. 1918, i. 484.
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- WEST, J. G., on blast-furnace construction. 1918, ii. 461.
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- WEST, P. C. H., on production of metallic tungsten. 1915, i. 633.
- WEST, R. H., on steel foundry practice. 1917, i. 355.
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- WEST, W.—
 Papers on "The corrosion of nickel, chromium and nickel-chromium steels." See FRIEND, J. N.
 Paper on "The mechanism of corrosion." See FRIEND, J. N.
- WEST, WALTER, elected member. 1915, i. 2.
- WESTCOTT, B. N., on power requirements of rolling-mills. 1912, i. 530.
- WESTERMANN, on electric equipment of collieries. 1911, ii. 528.
- WESTGARTH, G. W., on wire ropes. 1921, i. 447.
- WESTGATE, L. G., on iron ore in Montana. 1921, i. 374.
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- WETTICH, H., on iron-ore handling at Elba. 1911, ii. 486.
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- WETZEL, E., on corrosion of iron and steel. 1915, ii. 325; 1917, i. 417; 1918, ii. 505.
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- WEYL, F., on case-hardening of iron. 1911, i. 628.
- WEYMOUTH, C. R., on design of chimneys. 1920, ii. 477.
 on measurement of natural-gas. 1913, i. 561.
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- WEYMOUTH, T. R., on transport and storage of natural-gas. 1912, i. 478.
- WHALEY, W., on coal-handling. 1911, i. 578.

- WHARTON, EDWARD, elected member. 1921, i. 5.
- WHARTON, W. H., on reversing valves. 1921, ii. 374.
- WHEATLEY, H., on power requirements of rolling-mills. 1912, ii. 569.
- WHEATLEY, H. B., on history of charcoal iron manufacture. 1913, ii. 588.
- WHEATON, E. A., on basic open-hearth practice. 1921, i. 419.
- WHEELER, A. S., on melting-points of metals. 1912, ii. 607.
- WHEELER, B. P., on pre-melting of ferro-alloys. 1916, ii. 431 ; 1917, i. 363.
- WHEELER, E., on semi-steel. 1921, i. 413.
- WHEELER, H. A., on petroleum in Illinois. 1911, ii. 515 ; 1914, ii. 299.
- WHEELER, H. E., on nitrogen in steel. 1921, i. 464.
- WHEELER, R. V., on composition of coal. 1911, i. 542, ii. 506 ; 1914, i. 597.
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- WHEELWRIGHT, THOMAS STEWART, elected member. 1911, i. 4.
- WHERRY, E. T., on crystallography of manganese ore. 1919, i. 623.
 on uranium ore in Pennsylvania. 1915, i. 489.
- WHIGHAM, W., on fuel economy in the manufacture of steel. 1914, i. 672.
- WHILDIN, W. G., on mining thick coal-seams of steep pitch. 1915, i. 534.
- WHILE, ADOLPH SWAIN, obituary notice of. 1915, i. 465.
- WHILE, J. M., elected Vice-President. 1912, ii. 4.
- WHINERY, S., on iron ore in Tennessee and Kentucky. 1913, i. 514.
- WHIPPLE, G. C., on mill scale as a cause of corrosion. 1912, ii. 609.
- WHIPPLE, M. C., on mill scale as a cause of corrosion. 1912, ii. 609.
- WHIPPLE, N. D., on corrosion of metals by acids. 1919, i. 698.
- WHIPPLE, R. S., on pyrometry. 1911, i. 537 ; ii. 503 ; 1913, ii. 531 ; 1918, i. 481 ; 1921, ii. 384.
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- WHITAKER, DOUGLAS, elected member. 1913, ii. 5.
- WHITAKER, M. C., on coke by-products. 1917, ii. 370.
- WHITAKER, W. A., on petroleum in the United States. 1918, ii. 455.
- WHITE, A. E., on alloy steel. 1921, ii. 405.
 on briquetting iron ore. 1911, i. 533.
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- WHITE, A. H., on heat-treatment of steel. 1916, i. 359.
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- WHITE, C. A., on microscopic analysis of steel. 1913, i. 676, ii. 676.
- WHITE, D., on origin of coal. 1914, ii. 287 ; 1915, i. 505.
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- WHITE, E. E., on borehole surveying. 1913, i. 520.
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- WHITE, E. H., on autogenous welding. 1912, i. 552.
- WHITE, FRANK BULLER HOWARD, elected member. 1920, ii. 6.
- WHITE, G. A., on manufacture of steel sheets for galvanising. 1919, ii. 502.

- WHITE, G. R., on electrolytic corrosion. 1912, i. 594.
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- WHITE, JAMES, obituary notice of. 1912, i. 419.
- WHITE, J. W., on aerial ropeways. 1915, ii. 255.
- WHITE, MAUNSEL, obituary notice of. 1912, ii. 435.
- WHITE, W., on the iron-carbon system. 1912, i. 585.
- WHITE, SIR WILLIAM HENRY, K.C.B., F.R.S., obituary notice of. 1913, i. 492.
- WHITE, W. P., on calorimetry. 1911, ii. 501; 1920, i. 685.
 on fusion point of nickel. 1921, ii. 415.
 on potentiometers. 1920, i. 687.
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- WHITEFORD, J. F., on oxy-acetylene welding in boiler work. 1914, ii. 360.
- WHITEHEAD, R. H., on coal-dust experiments. 1911, ii. 534.
- WHITEHOUSE, BENJAMIN, obituary notice of. 1913, i. 493.
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Paper: "Note on the warping of steel through repeated quenching." 1918, ii. 211.—*Discussion*: J. E. Stead, 215.

Paper on "The distribution of phosphorus in steel between the points Acl and Ac3." 1920, i. 359; description of materials used and method of etching, 360; diffusion of carbon between the points Acl and Ac3, 362; diffusion of phosphorus between the points Acl and Ac3, 362; evidence showing that the diffusion effect is due to phosphorus, 370; distribution of the phosphorus between the two phases, 375; formation of a reticulated or cellular structure due to phosphorus, 377; microghost lines in steel plates, summary, 381.—*Discussion*: J. E. Stead, 383; F. C. Thompson, 383; J. E. Stead, 384; H. Wrighton, 384.—*Correspondence*: W. H. Hatfield, 385; J. H. Whiteley (reply), 386.

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Paper on "Cupric etching effects produced by phosphorus and oxygen in iron." 1921, i. 277; experiments on the uneven distribution of phosphorus, 281; experiments in the uneven distribution of oxygen, 284; summary, 288.—*Discussion*: 290.—*Correspondence*: 294.

Paper on "The Eggertz test for combined carbon in steel." C.S.M., 1917, viii. 1; introduction, 1; Part I: Method for the estimation of small amounts of carbon dioxide, 2; Part II: Estimation of the carbon compounds contained in the gases given off in the Eggertz tests, 8; Part III: The Eggertz test, 21; Part IV: The correlation of the Brinell test and the colour carbons, 80.

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- on Eggertz method of carbon estimation. 1917, ii. 463.
- on estimation of sulphur in iron and steel. 1914, ii. 391; 1921, i. 339.
- on inclusions in steel and ferrite lines. 1918, i. 294.
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- on nickel-chrome steels. 1919, ii. 399.
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- on oxygen in iron. 1921, i. 295.
- on slag in the open-hearth process. 1920, i. 308.
- on steel-ingot defects. 1917, i. 102.
- on structure of chromium steels. 1920, i. 523.
- on welding-up of blowholes in ingots. 1921, i. 48.
- elected member. 1917, i. 4.
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Paper on "The acid hearth and slag." 1919, i. 199; Part I: Micro-structure and mineral composition of acid slags, 199; minerals occurring in acid slags, 202; description of microstructure of slags, 206; ternary diagram, $\text{FeO-MnO}_2\text{-SiO}_2$, 209; slags containing lime, 213; structure of reheated acid slags, 213; structure of quickly cooled slag samples, 214; Part II: The acid hearth, 216; Part III: The molten slag, 223; summary, 240.—*Discussion*: E. H. Saniter, 243; F. Rogers, 243; A. McCance, 244; J. E. Stead, 245.—*Correspondence*: H. M. Howe, 246; J. E. Fletcher, 247; B. Yaneske, 250; J. H. Whiteley and A. F. Hallimond (reply), 251.

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Paper on "The chemical detection of strain in iron and steel by their reaction with nitric acid." **C.S.M.**, 1918, ix. 1; Part I: Analysis of the gases formed on solution of iron in nitric acid: the chemical reactions involved, 1; Part II: Effect of strain upon the reaction of iron with nitric acid, 28.

WHITELEY, WILLIAM, elected member. 1917, i. 4.

WHITFIELD, HUBERT EDWIN, elected member. 1919, i. 6

WHITFIELD, C., on gas-producer plant. 1917, ii. 378.

WHITFIELD, RICHARD, elected member. 1920, ii. 6.

WHITFIELD, T. C., on haulage in collieries. 1912, ii. 513.

WHITNEY, A. W., on foundry mixtures. 1912, i. 513.

WHITNEY, P. B., on effect of cold-twisting on properties of mild steel bars. 1917, i. 400.

WHITTAKER, C. M., on British coal-tar colour industry. 1916, ii. 403.

WHITTAKER, F., on lighting of collieries. 1915, i. 537.

WHITTAM, G. C., on estimation of chromium and vanadium in steel. 1915, ii. 330.

WHITTIER, E. S., on black-finishing of iron and steel. 1919, i. 671.

WHITTLEMORE, H. L., on oxy-acetylene welding. 1911, ii. 603.

- WHITTOME, A. C., on mine ventilation. 1915, ii. 254.
- WHITTON, C. F., on iron industry of Canada. 1918, ii. 464.
- WHITTON, FRANCIS HENRY, elected member. 1918, i. 6.
- WHITWELL, WILLIAM, reference to death of. 1911, i. 16.
- WHYTE, S., on corrosion of iron and alloys. 1916, i. 391.
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- WICHERT, A., on rail corrugation. 1921, ii. 406.
- WICKENDEN, L., on Bourcoud direct process. 1921, ii. 367.
- WICKHORST, M. H., on aluminium in rail steel. 1914, ii. 373.
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- WICKSTEED, C., on steelworks equipment. 1912, ii. 572.
- WIDDAS, SOUTHERN, elected member. 1919, i. 6.
- WIDDOWSON, JAMES GEORGE, elected member. 1917, ii. 5.
- WIGHT, J. T., on tests of split links for chains. 1914, ii. 371.
- WIGHT-BOYCOTT, R., on production of sound ingots. 1915, i. 82.
- WIGLEY, W. R., on heat-treatment of steel. 1915, i. 586.
- WIGNY, C., on coke-oven gas-fired open-hearth furnaces. 1911, i. 618.
- WIHTOL, A., on peat-gas producers. 1913, ii. 562.
- WILBUR, F. I., on origin of petroleum. 1911, i. 553.
- WILCOCKSON, W. H., on tungsten ore. 1920, i. 674.
- WILCOX, E. A., on electric furnace practice. 1920, i. 718.
- WILCOX, W. G., on pulverised coal. 1919, i. 636.
- WILCZEK, A., on efficiency of modern coke-ovens. 1914, i. 604.
- WILD, F. D., on cleaning blast-furnace gas. 1920, ii. 86.
- WILD, L. W., on electric heat-treatment furnace. 1921, i. 436.
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- WILD, RONALD, elected member. 1920, i. 6.
- WILD, T. C., on development of gas-engine in England. 1914, i. 620.
elected member. 1920, i. 6.
- WILDA, H., on pyrometry. 1915, ii. 230.
- WILDT, E. A., on electric welding. 1917, i. 386.
- WILE, R. S., on manufacture of ferro-alloys. 1915, ii. 283.
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- WILEY, B., on electric-driving of rolling-mills. 1911, i. 609; 1918, i. 521.
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- WILEY, D. A., on coal-briquetting. 1914, i. 635.

- WILHELM, R. M., on high temperature thermometers. 1920, i. 686.
- WILHELME, A., on sampling and analysis of gas. 1911, ii. 668.
- WILKIE, W. M., on heat-treatment of steel. 1919, ii. 507.
- WILKINSON, DANIEL, elected member. 1918, i. 6.
- WILKINSON, FRANK SIDNEY, elected member. 1918, i. 6.
- WILKINSON, THOMAS STRATFORD, elected member. 1921, i. 5.
- WILLARD, A. C., on heat-transmission of building materials. 1918, ii. 445.
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- WILLE, H., on tests on electric winding-engine. 1912, ii. 512.
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- WILLEY, D. A., on agglomeration of iron ores. 1913, i. 525.
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- WILLIAMS, A. D., on design of hot-blast stoves. 1918, ii. 462.
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- WILLIAMS, C. F., on American rolling-mills. 1915, i. 581.
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- WILLIAMS, DAVID REES PERCY, elected member. 1920, i. 6.
- WILLIAMS, F. C., elected member. 1921, i. 5.
- WILLIAMS, FREDERICK GEORGE, elected member. 1912, i. 4.
- WILLIAMS, F. H., on electric welding. 1921, i. 445.
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- WILLIAMS, G., on rotary castings machines. 1920, ii. 354.
- WILLIAMS, G. T., on elastic hysteresis of steel. 1913, i. 663.
- WILLIAMS, H., on estimation of iron sulphide by electrolytic means. 1918, ii. 508.
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- WILLIAMS, H. E., on chromite deposits of Brazil. 1921, i. 370.
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- WILLIAMS, ILLTYD, on briquetting iron ores. 1917, ii. 55.
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- WILLIAMS, ISAAC, elected member. 1920, ii. 6.
- WILLIAMS, J., on Welsh tin-plate rolling-mill practice. 1915, i. 591.
- WILLIAMS, J. G. H., on welding. 1921, ii. 393.
- WILLIAMS, J. H., on Canadian foundries. 1912, ii. 551; 1913, i. 616.

- WILLIAMS, LESLIE B., on producer-gas from wood. 1919, i. 645.
- WILLIAMS, N. H., on magnetisation of steel rods. 1914, ii. 377.
- WILLIAMS, N. T., on methods of coal-mining in China. 1913, i. 572.
- WILLIAMS, P. S., on methods of mining iron ore. 1911, i. 527.
- WILLIAMS, R. D., on a Canadian rolling-mill. 1913, ii. 634.
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- WILLIAMS, S. R., on magnetic analysis of cast iron. 1920, i. 749.
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- WILLIAMS, T. B., on coke-oven practice in Western Canada. 1915, i. 514.
- WILLIAMS, W. A., on petroleum in the United States. 1917, i. 322.
- WILLIAMS, WILLIAM ELLIS, elected member. 1919, i. 6.
- WILLIAMSON, ALEXANDER, elected member. 1918, i. 6.
- WILLIAMSON, HUGH HENSHALL, elected member. 1914, i. 4.
- WILLIAMSON, S. W., on acid open-hearth process. 1917, ii. 205.
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- WILLIAMSON, THOMAS OGILVIE, elected member. 1919, i. 6.
- WILLIS, ARTHUR WILLIAM, elected member. 1918, i. 6.
- WILLIS, B., on geological distillation of petroleum. 1920, ii. 332.
- WILLIS, F. W., on determination of hardness. 1919, i. 684.
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- WILLIS, GEORGE OSWALD BELL, elected member. 1918, ii. 4.
- WILLIS, R. H., on electric equipment of collieries. 1912, i. 485.
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- WILLMOTT, A. B., on iron ore in Canada. 1911, ii. 476.
- WILLMOTT, H. B., on history of rock-drilling. 1917, ii. 344.
- WILLOX, W., on tests on wear of rails. 1914, i. 708.
- WILMOT, F. A., on triplex steel process. 1914, i. 673.
- WILSON, A. B., on defects in steel. 1921, i. 429.
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- WILSON, A. J., on use of liquid fuel. 1920, ii. 338; 1921, i. 393.
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- WILSON, ARTHUR KINGSFORD, elected member. 1919, i. 6.
- WILSON, A. W. G., on iron ore in Canada. 1911, i. 518.
- WILSON, C. B., on inspection of automobile castings. 1915, ii. 295.
- WILSON, D., on carbon-free ferro-nickel. 1920, ii. 360.
- WILSON, D. R., on artificial lighting of iron foundries. 1913, ii. 609.
- WILSON, D. W., on heat-balance of hot-blast stoves. 1921, ii. 363.
- WILSON, E., on influence of temperature on hysteresis loss in iron. 1912, ii. 599.

- WILSON, E., on magnetic properties of iron. 1914, ii. 376.
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- WILSON, E. B., on by-product coke-ovens. 1911, i. 551; 1912, ii. 490; 1915, i. 516.
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- WILSON, FRANCIS, elected associate. 1917, i. 6.
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- WILSON, FREDERICK PORTWAY, elected member. 1920, i. 6.
- WILSON, F. W., on cleaning of castings. 1921, i. 416.
- WILSON, G. V., on iron ore in Scotland. 1920, i. 668.
- WILSON, H. A., on iron ore in Newfoundland. 1919, i. 617.
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- WILSON, H. W., on petroleum industry of Mexico. 1913, ii. 719.
- WILSON, J., on shaft sinking. 1914, i. 621.
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- WILSON, J. A., on recovery of benzol from gas. 1917, i. 318.
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- WILSON, J. L., on foundry equipment. 1921, i. 417.
- WILSON, J. M., on heat-treatment and testing of shrapnel shells. 1915, ii. 298.
- WILSON, J. R. R., on methods of mining coal in India. 1913, i. 572.
- WILSON, J. S. G., on coal in Scotland. 1920, i. 692.
- WILSON, J. V., on history and progress of liquid fuel. 1914, ii. 303.
- WILSON, L. C., on corrosion of iron and steel. 1915, i. 625.
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- WILSON, M. E., on graphite in Quebec. 1917, i. 303.
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- WILSON, R., on coal in the United States. 1915, ii. 234.
- WILSON, ROBERT MARTILL, elected member. 1919, i. 6.
- WILSON, R. P., on iron sands of New Zealand. 1917, ii. 34.
- WILSON, R. R., on methods of working coal. 1914, ii. 309.
- WILSON, ROBERT S., elected member. 1920, i. 6.
- WILSON, S. R., on estimation of iron. 1914, ii. 393.
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- WILSON, T., on special form of gas-producer. 1914, ii. 304.
WILSON, T. D., on moulding sand. 1911, i. 600.
WILSON, W., on blast-furnace practice. 1920, i. 219.
WILSON, WILLEY, elected member. 1918, i. 6.
WILSON, W. B., on shaft-sinking. 1911, ii. 525.
WILSON, W. J. B., on failure of steel ship plates. 1915, i. 612.
WILSON-DICKSON, J. G., obituary notice of. 1914, i. 556.
WILTSHIRE, J. C., on elimination of strains in iron castings. 1920, i. 732.
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WINGFIELD, C. H., on growth of cast iron. 1911, i. 243.
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WINTER, H., on microstructure of coal. 1913, ii. 536; 1914, i. 597.
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WITHEL, A., on the Wielandt coke-oven. 1914, ii. 295.
WITHERBEE, F. S., on the iron ore of the Adirondack Region. 1917, i. 283.
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- WITTICH, L. L., on transportation of natural-gas. 1913, i. 561.
- WITTORE, on the constitution of iron carbon alloys. 1912, ii. 600.
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- WOAKES, E. R., on molybdenum in Norway. 1918, i. 472.
- WÖBLING, H., on corrosion of cast iron and steel plates. 1913, ii. 689.
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- WOLOGDINE, L., on heat-formation of silicates. 1912, i. 589.
- WOLOGDINE, S., on formation of manganese sulphide. 1914, i. 730.
- WOLSTERHOLME, GEORGE ETHELBERT, elected member. 1919, ii. 5.
- WOLTERECK, W., on peat-gas production. 1911, ii. 524.
- WOLTERSDOFF, on coal-dust experiments. 1913, ii. 571.
- WOLTJER, H. R., on magnetic properties of alloys. 1921, ii. 408.
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- WOOD, CYRIL, elected associate. 1917, i. 6.
- WOOD, E. E., on bosh tuyeres. 1918, ii. 226.
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- WOOD, E. S., on electricity in mines. 1911, i. 565.
- WOOD, G. A.—
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- WOOD, HAROLD CARRINGTON, elected member. 1918, i. 6.
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- WOOD, H. M., on influence of elements on cast iron. 1914, i. 721.

- WOOD, H. M., on use of cast iron for machine-tool parts. 1914, i. 659.
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- WOOD, P. L., on shaft sinking. 1915, i. 530.
- WOOD, STUART, obituary notice of. 1914, i. 557; 1915, i. 465.
- WOOD, W., on tests of cast iron. 1911, ii. 611.
- WOOD, W. P., on heat-treatment of steel. 1921, i. 441.
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- WOODHOUSE, W. B., on cost of power in collieries. 1915, i. 540.
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- WOODS, ROLAND, elected member. 1919, i. 6.
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- WOODWARD, H. P., on coal in Western Australia. 1915, i. 511; 1916, i. 309; 1917, i. 312.
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- WOODWARD, R. C., on ingot-casting in corrugated moulds. 1916, ii. 433.
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- WOOF, THOMAS, elected member. 1911, i. 4.
- WOOLDRIDGE, WILLIAM JOHN, elected member. 1919, i. 6.
- WOOLSEY, L. H., on coal in Montana. 1920, ii. 326.
- WOOLSON, I. H., on corrosion of iron. 1911, i. 676.
- WOOTON, P., on iron ore in Alabama. 1912, ii. 451.
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- WORCESTER, S. A., on iron and steel electrical conductors. 1916, ii. 459.
- WORKER, J. G., on underfed stoker for boilers. 1919, ii. 470.
- WOROBIEW, W., on blast-furnace gas-firing for open-hearths. 1914, ii. 337.

- WORRALL, J. W., on patterns for motor-car work. 1913, i. 612.
- WORRALL, STANLEY, elected member. 1919, i. 6.
- WORRELL, S. H., on coal-fields of Texas. 1914, ii. 290.
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- WORSDELL, W., on steel for locomotives. 1911, i. 656.
- WORSLEY, E., on causes of boiler-plate failures. 1918, i. 542.
- WORTH, B. G., on corrosion of boiler tubes. 1921, i. 470.
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- WORTHING, A. G., on temperature of non-black bodies. 1920, i. 687.
- WORTHINGTON, W. H., on estimation of silica. 1911, ii. 667.
- WOTHERSPOON, W. L., on pulverised coal. 1920, i. 690.
- WOURTZEL, E., on atomic weight of nitrogen. 1912, i. 613.
- WRAGG, A.—
Paper on "The effect of initial temperature on physical properties of steel." See ANDREW, J. H.
- WRIGHT, E. A., on standardisation of mining plant. 1921, i. 461.
- WEATHA, L. L., on petroleum in South Australia. 1916, i. 317.
- WRATHER, W. E., on petroleum in Texas and Louisiana. 1914, i. 611.
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- WRAY, D. A., on coal resources of Jugo-slavia. 1921, ii. 347.
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- WRENDL, on natural-gas in Hungary. 1914, i. 615.
- WRENSHALL, R., on estimation of titanium. 1914, i. 748.
- WRENTMORE, C. G., on strength of reinforced concrete beams. 1914, i. 712.
- WRIGHT, ALBERT, elected member. 1911, ii. 11.
- WRIGHT, ALFRED FITZHERBERT MELVILLE, elected member. 1921, ii. 11.
- WRIGHT, C. A., on methods of working iron ore. 1915, ii. 223.
- WRIGHT, C. E., on cement from blast-furnace slag. 1919, ii. 489.
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- WRIGHT, C. H., on electric motors for mines. 1914, ii. 308.
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- WRIGHT, C. L., on briquetting of fuel. 1911, ii. 539; 1912, ii. 579; 1914, ii. 315.
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- WRIGHT, C. W., on estimation of manganese, vanadium and titanium. 1914, i. 743.
- WRIGHT, CHARLES WILLIAM, elected member. 1920, i. 6.
- WRIGHT, E. N., on gas-producers. 1915, ii. 250.
- WRIGHT, F. E., on examination of ores in polarised light. 1920, ii. 312.
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- WRIGHT, GODFREY, elected member. 1914, i. 4.
- WRIGHT, GERALD SPYVEE, elected associate. 1921, i. 6.
- WRIGHT, H. E.—
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- WRIGHT, L. T., on sampling of ores. 1911, i. 685.
- WRIGHT, N. L., on iron sands of New Zealand. 1917, ii. 341.
- WRIGHT, P., on petroleum in United States. 1918, i. 455.
- WRIGHT, RONALD BLYTHE, elected associate. 1919, i. 7.
- WRIGHT, WILLIAM, elected member. 1920, i. 6.
- WRIGHT, W. C., on estimation of chromium. 1919, ii. 539.
- WRIGHTON, H., on distribution of phosphorus in steel between the points Ac1 and Ac3. 1920, i. 384.
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- WRIGHTSON, SIR THOMAS, BART., on welding-up of blowholes in steel. 1911, i. 89.
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- WROE, J. H., on mine drainage. 1914, i. 625.
- WULFRATH, E., on installations for mechanical charging of cupolas. 1915, i. 558.
- WUNDER, M., on action of phosphoric acid on alloys. 1911, ii. 648.
on estimation of iron in iron alloys. 1913, i. 690.
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on separation of iron, chromium and aluminium. 1911, i. 683, ii. 662.
- WUNDERLICH, G., on methods of working coal in Bohemia. 1914, ii. 309.
- WUNSCH, F., on pyrometry. 1920, i. 688.
- WUNSCH, J. W., on rustless coatings of iron and steel. 1918, ii. 506.
- WUNSCH, R., on tungsten-carbon alloys. 1914, i. 728.
- WUNSTORF, W., on coal in Germany. 1912, i. 463.
- WURSTER, A. L., on die-blocks. 1921, i. 442.
- WÜRTH, PAUL, elected member. 1913, ii. 5.
- WURZEL, S., on analysis of iron ore. 1915, i. 632.
- WÜST, F., on briquetted cuttings in the cupola. 1916, i. 339.
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- WÜSTEFELD, on producer-gas from low grade fuel. 1912, ii. 503.
- WYBERGH, W. J., on classification of coal. 1921, ii. 344.
- WYLDE, WILLIAM GEORGE COLQUHOUN, elected member. 1916, i. 4.
- WYNNE-ROBERTS, R. O., on coal in Canada. 1913, ii. 541.
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- WYBELL, RALPH SANDRUTH, elected member. 1920, i. 6.
- WYSOR, R. J., on origin of hydrogen in blast-furnace gas. 1911, ii. 544.
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YARZA, R. A. DE, on iron ore in Cuba. 1912, i. 440.

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YATSEWITCH, M., on tests of high-speed steel. 1918, i. 540.

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YEADON, J. A., on coal-briquetting. 1917, ii. 387; 1919, i. 646.

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- YOUATT, CLAUDE SEPTIMUS, elected member. 1918, ii. 4.
- YOUNG, C. D., on heat-treatment of steel castings. 1914, i. 694.
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- ZEIGLER, S. J., on corrosion of common metals. 1914, ii. 386.
- ZEIPEL, P. VON, on gas-producers. 1911, i. 559.
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- ZEMIATCENSKY, P., on Russian fireclays. 1917, i. 301.
- ZENZES, A., on foundry irons. 1914, i. 658.
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- ZIEGLER, on crystallisation of alpha iron. 1911, ii. 640.
- ZIEM, M., on by-products from German coal. 1916, i. 314.

- ZILLGEN, M., on smelting minette ores. 1915, i. 546.
- ZIMMER, E. B., on determination of grain-size in metals. 1916, i. 387.
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- ZINBERG, S., on estimation of constituents in alloys. 1913, ii. 703.
 on estimation of copper. 1912, i. 604.
 on rapid determination of carbon in iron alloys. 1917, ii. 463.
- ZIP, H. Z., on hardness of minerals. 1911, ii. 621.
- ZIPPLER, F. J., on new system of tuyeres. 1916, i. 332.
- ZIX, E., on explosives testing gallery at Derne. 1913, i. 571.
 on German rolling-mill engines. 1915, i. 578.
- ZSCHIEGNER, H., on estimation of sulphur. 1916, i. 400.
- ZUBLENA, S., on behaviour of slag enclosures in acid steel. 1917, i. 394.
 on control of quenching temperature of steel in large masses. 1914, i. 694.
 on properties of steel castings. 1920, i. 740.
- ZUCCARI, G., on estimation of nickel. 1915, ii. 331.
- ZWIAUER, P., on testing welded boiler-joints. 1912, ii. 588.
- ZYROMSKI, on blast-furnace reactions. 1912, i. 495.
 on French rolling-mills. 1911, i. 613.



